THE FIRST REACTOR

U. S. ATOMIC ENERGY COMMISSION / Division of Technical Information

ONE
OF A SERIES ON
UNDERSTANDING THE ATOM

UNITED STATES
ATOMIC ENERGY COMMISSION

Dr. Glenn T. Seaborg, Chairman
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Dr. Gerald F. Tape
Wilfrid E. Johnson

Nuclear energy
is playing a vital role
in the life of
every man, woman, and child
in the United States today.
In the years ahead
it will affect increasingly
all the peoples of the earth.
It is essential
that all Americans
gain an understanding
of this vital force if
they are to discharge thoughtfully
their responsibilities as citizens
and if they are to realize fully
the myriad benefits
that nuclear energy
offers them.

The United States
Atomic Energy Commission
provides this booklet
to help you achieve
such understanding.

Edward J. Brunenkant

Edward J. Brunenkant
Director
Division of Technical Information

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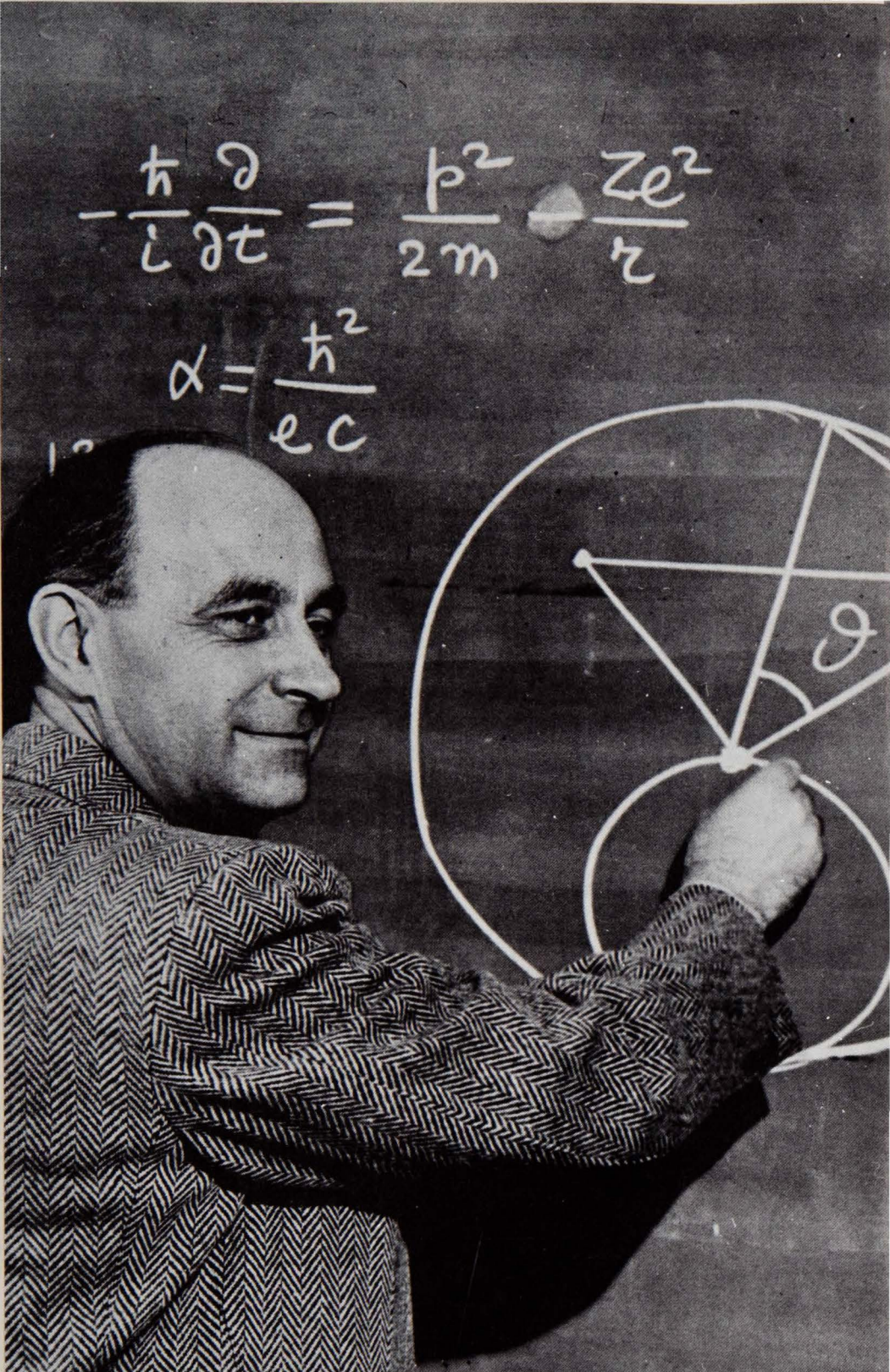
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THE FIRST REACTOR

THE SIGNIFICANCE OF DECEMBER 2, 1942

Throughout history, only a few single events have materially altered the course of civilization. Among these was the completion and successful operation of the first nuclear reactor, an accomplishment that has been compared to the invention of the steam engine or the manufacture of the first automobile in its impact on the future and its significance for social change.

Creation of the first reactor made it possible to release and use the huge forces locked in the hearts of atoms. This energy was first employed in wartime, for atomic bombs. Then, over the years, other reactors — more technologically sophisticated, more ingenious, more powerful — were built and employed to channel the energy of the atomic nucleus into peaceful pursuits — the generation of electricity, the conquest of disease, the pursuit of knowledge, the identification, measurement and testing of materials, the propulsion of ships and rockets, and many others. There is great promise of still more wonders for the future — wonders that will become commonplace as the Atomic Age progresses.

The story of the first primitive reactor, then, is an account of the birth of a new era. To understand atomic energy as a force that shaped that era, and to give meaning to the present and perspective to the future, it is interesting and rewarding to know how the era began. This booklet tells the story in three ways — in the words of two men whose job it was to report an event in which others, more renowned and more directly concerned, participated — in the words of the most famous of the dedicated participants, whose wisdom, confidence, and leadership inspired the hoped-for result — and in the words of that leader's wife, who did not learn until long afterward of the event of December 2, 1942.

Enrico Fermi, the Italian physicist, led the team of scientists who built the first nuclear reactor.

THE FIRST PILE

By Corbin Allardice and Edward R. Trapnell

On December 2, 1942, man first initiated a self-sustaining nuclear chain reaction, and controlled it.

Beneath the West Stands of Stagg Field,* Chicago, late in the afternoon of that day, a small group of scientists witnessed the advent of a new era in science. History was made in what had been a squash-rackets court.

Precisely at 3:25 p.m., Chicago time, scientist George Weil withdrew the cadmium-plated control rod and by his action man unleashed and controlled the energy of the atom.

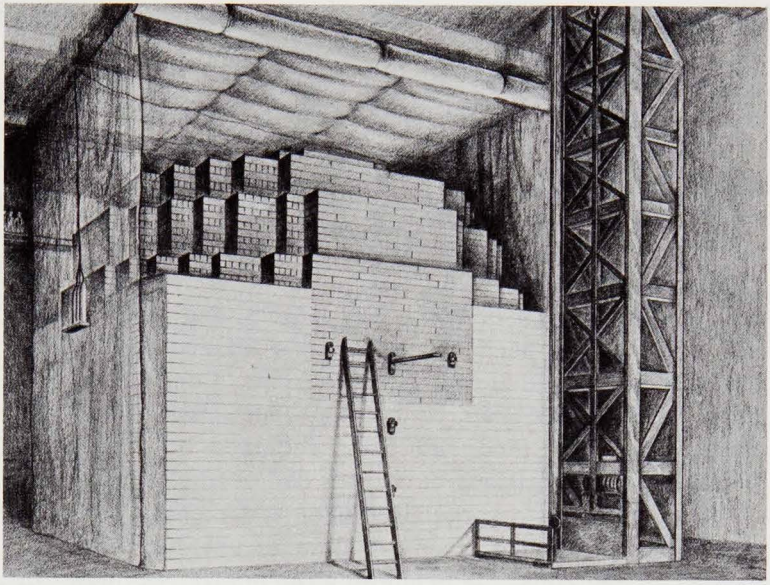
As those who witnessed the experiment became aware of what had happened, smiles spread over their faces and a quiet ripple of applause could be heard. It was a tribute to Enrico Fermi, Nobel Prize winner, to whom, more than to any other person, the success of the experiment was due.

Fermi, born in Rome, Italy, on September 29, 1901, had been working with uranium for many years. In 1934 he bombarded uranium with neutrons and produced what appeared to be element 93 (uranium is element 92) and element 94. However, after closer examination it seemed as if nature had gone wild; several other elements were present, but none could be fitted into the periodic table near uranium — where Fermi knew they should have fitted if they had been the transuranic elements 93 and 94. It was not until five years later that anyone, Fermi included, realized he had actually caused fission of the uranium and that these unexplained elements belonged back in the middle part of the periodic table.

Fermi was awarded the Nobel Prize in 1938 for his work on transuranic elements. He and his family went to Sweden to receive the prize. The Italian Fascist press severely criticized him for not wearing a Fascist uniform and failing to give the Fascist salute when he received the award. The Fermis never returned to Italy.

From Sweden, having taken most of his personal possessions with him, Fermi proceeded to London and thence to

*The University of Chicago athletic stadium.



Sketch of the first pile. Around it is a tent of balloon cloth fabric, prepared so that the reactor could be sealed to minimize nonproductive loss of neutrons if necessary; the tent was never used. This is one of two drawings made in 1946 and based on physical measurements of the reactor and recollections of the scientists. (The other drawing is on page 33.)

America where he has remained ever since.*

The modern Italian explorer of the unknown was in Chicago that cold December day in 1942. An outsider looking into the squash court where Fermi was working would have been greeted by a strange sight. In the center of the 30 by 60 foot room, shrouded on all but one side by a gray balloon cloth envelope, was a pile of black bricks and wooden timbers, square at the bottom and a flattened sphere on top. Up to half of its height, its sides were straight. The top half was domed, like a beehive. During the construction of this crude appearing but complex pile (the name which has since been applied to all such devices) †

*Dr. Fermi died in Chicago, Illinois, November 28, 1954.

†The term "pile," in use for the first few years of the atomic age, gradually gave way to "reactor" to identify the key device that controls the nuclear fission reaction.

the standing joke among the scientists working on it was: "If people could see what we're doing with a million-and-a-half of their dollars, they'd think we are crazy. If they knew why we are doing it, they'd be sure we are."

In relation to the fabulous atomic bomb program, of which the Chicago Pile experiment was a key part, the successful result reported on December 2nd formed one more piece for the jigsaw puzzle which was atomic energy. Confirmation of the chain reactor studies was an inspiration to the leaders of the bomb project, and reassuring at the same time, because the Army's Manhattan Engineer District had moved ahead on many fronts. Contract negotiations were under way to build production-scale nuclear chain reactors, land had been acquired at Oak Ridge, Tennessee, and millions of dollars had been obligated.

Three years before the December 2nd experiment, it had been discovered that when an atom of uranium was bombarded by neutrons, the uranium atom sometimes was split, or fissioned. Later, it had been found that when an atom of uranium fissioned, additional neutrons were emitted and became available for further reaction with other uranium atoms. These facts implied the possibility of a chain reaction, similar in certain respects to the reaction which is the source of the sun's energy. The facts further indicated that if a sufficient quantity of uranium could be brought together under the proper conditions, a self-sustaining chain reaction would result. This quantity of uranium necessary for a chain reaction under given conditions is known as the critical mass, or more commonly, the "critical size" of the particular pile.

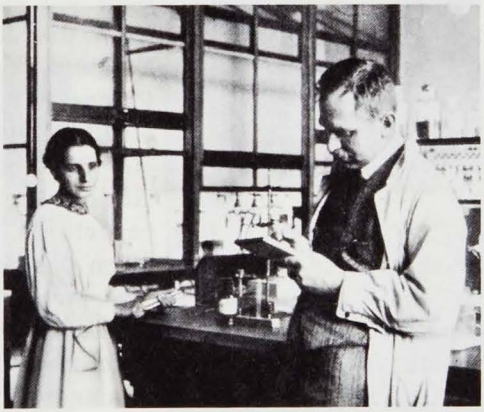
For three years the problem of a self-sustaining chain reaction had been assiduously studied. Nearly a year after Pearl Harbor,* a pile of critical size was finally constructed. It worked. A self-sustaining nuclear chain reaction was a reality.

*The Japanese attacked the American naval base at Pearl Harbor, Hawaiian Islands, December 7, 1941; this attack brought the United States into World War II.

Years of Preliminary Research

Years of scientific effort and study lay behind this demonstration of the first self-sustaining nuclear chain reaction. The story goes back at least to the fall of 1938 when two German scientists, Otto Hahn and Fritz Strassman, working at the Kaiser Wilhelm Institute in Berlin, found barium in the residue material from an experiment in which they had bombarded uranium with neutrons from a radium-beryllium source. This discovery caused tremendous excitement in the laboratory because of the difference in atomic mass between the barium and the uranium. Previously, in residue material from similar experiments, elements other than uranium had been found, but they differed from the uranium by only one or two units of mass. The barium differed by approximately 98 units of mass. The question was, where did this element come from? It appeared that the uranium atom when bombarded by a neutron had split into two different elements, each of approximately half the mass of the uranium.

Before publishing their work in the German scientific journal *Die Naturwissenschaften,* Hahn and Strassman communicated with Lise Meitner who, having fled the Nazi-controlled Reich,* was working with Niels Bohr in Copenhagen, Denmark.



Lise Meitner and Otto Hahn in their laboratory in the 1930s.

*Germany under Adolf Hitler's Nazi Party rule was known as the "Third Reich" (Third Realm).

Miss Meitner was very much interested in this phenomenon and immediately attempted to analyze mathematically the results of the experiment. She reasoned that the barium and the other residual elements were the result of a fission, or breaking, of the uranium atom. But when she added the atomic masses of the residual elements, she found this total was less than the atomic mass of uranium.

There was but one explanation: The uranium fissioned or split, forming two elements each of approximately half of its original mass, but not exactly half. Some of the mass of the uranium had disappeared. Miss Meitner and her nephew O. R. Frisch suggested that the mass which disappeared was converted into energy. According to the theory advanced in 1905 by Albert Einstein in which the relationship of mass to energy was stated by the equation $E = mc^2$ (energy is equal to mass times the square of the speed of light), this energy release would be of the order of 200,000,000 electron volts for each atom fissioned.

Bohr's Trip to America

Niels Bohr

Einstein himself, nearly thirty-five years before, had said this theory might be proved by further study of radioactive elements. Bohr was planning a trip to America to discuss other problems with Einstein who had found a haven at Princeton's Institute for Advanced Studies. Bohr came to America, but the principal item he discussed with Einstein was the report of Meitner and Frisch. Bohr arrived at Princeton on January 16, 1939. He talked to Einstein and J. A. Wheeler who had once been his student. From Princeton the news spread by word of mouth to neighboring physicists, including Enrico Fermi at Columbia. Fermi and his associates immediately began work to find the heavy pulse of ionization which could be expected from the fission and consequent release of energy.

Before the experiments could be completed, however, Fermi left Columbia to attend a conference on theoretical physics at George Washington University in Washington, D. C. Here Fermi and Bohr exchanged information and discussed the problem of fission. Fermi mentioned the possibility that neutrons might be emitted in the process. In this conversation, their ideas of the possibility of a chain reaction began to crystallize.

Before the meeting was over, experimental confirmation of Meitner and Frisch's deduction was obtained from four laboratories in the United States (Carnegie Institution of Washington, Columbia, Johns Hopkins, and the University of California). Later it was learned that similar confirmatory experiments had been made by Frisch and Meitner on January 15th. Frederic Joliot-Curie in France, too, confirmed the results and published them in the January 30th issue of the French scientific journal, *Comptes rendus.*

On February 27, 1939, the Canadian-born Walter H. Zinn and Leo Szilard, a Hungarian, both working at Columbia University, began their experiments to find the number of neutrons emitted by the fissioning uranium. At the same time, Fermi and his associates, Herbert L. Anderson and H. B. Hanstein, commenced their investigation of the same problem. The results of these experiments were published side-by-side in the April edition of the *Physical Review* and showed that a chain reaction might be possible since the uranium emitted additional neutrons when it fissioned.

Walter H. Zinn

Leo Szilard

F. D. Roosevelt

After the discovery of uranium fission in 1939, it became apparent that a powerful weapon might be developed based on this concept. Leo Szilard was one of the scientists who felt strongly that the government should begin intensive work especially since the Nazis were probably following a similar line of research. He discussed this with Eugene Wigner, Albert Einstein, and Alexander Sachs, an economist who had access to the White House. A letter was drafted that would be delivered to President Franklin Roosevelt by Sachs along with scientific

Albert Einstein
Old Grove Rd.
Nassau Point
Peconic, Long Island

August 2nd, 1939

F.D. Roosevelt,
President of the United States,
White House
Washington, D.C.

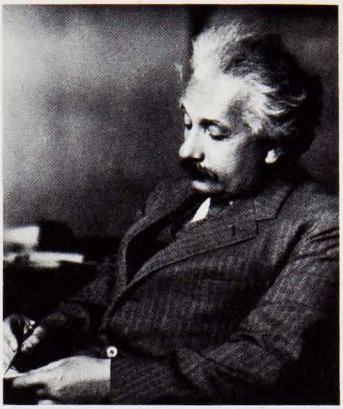
Sir:

Some recent work by E.Fermi and L. Szilard, which has been communicated to me in manuscript, leads me to expect that the element uranium may be turned into a new and important source of energy in the immediate future. Certain aspects of the situation which has arisen seem to call for watchfulness and, if necessary, quick action on the part of the Administration. I believe therefore that it is my duty to bring to your attention the following facts and recommendations:

In the course of the last four months it has been made probable - through the work of Joliot in France as well as Fermi and Szilard in America - that it may become possible to set up a nuclear chain reaction in a large mass of uranium,by which vast amounts of power and large quantities of new radium-like elements would be generated. Now it appears almost certain that this could be achieved in the immediate future.

This new phenomenon would also lead to the construction of bombs, and it is conceivable - though much less certain - that extremely powerful bombs of a new type may thus be constructed. A single bomb of this type, carried by boat and exploded in a port, might very well destroy the whole port together with some of the surrounding territory. However, such bombs might very well prove to be too heavy for transportation by air.

reports confirming the theory. Einstein was asked to sign it since he was one of the most distinguished scientists in the country. After reading it he said, "For the first time in history, men will use energy that does not come from the sun". Sachs delivered the letter (reproduced below) and the reports. President Roosevelt subsequently appointed the Advisory Committee on Uranium, which, on November 1, reported that a chain reaction was a possibility and that the government should support a thorough investigation.



Albert Einstein

-2-

The United States has only very poor ores of uranium in moderate quantities. There is some good ore in Canada and the former Czechoslovakia, while the most important source of uranium is Belgian Congo.

In view of this situation you may think it desirable to have some permanent contact maintained between the Administration and the group of physicists working on chain reactions in America. One possible way of achieving this might be for you to entrust with this task a person who has your confidence and who could perhaps serve in an inofficial capacity. His task might comprise the following:

a) to approach Government Departments, keep them informed of the further development, and put forward recommendations for Government action, giving particular attention to the problem of securing a supply of uranium ore for the United States;

b) to speed up the experimental work, which is at present being carried on within the limits of the budgets of University laboratories, by providing funds, if such funds be required, through his contacts with private persons who are willing to make contributions for this cause, and perhaps also by obtaining the co-operation of industrial laboratories which have the necessary equipment.

I understand that Germany has actually stopped the sale of uranium from the Czechoslovakian mines which she has taken over. That she should have taken such early action might perhaps be understood on the ground that the son of the German Under-Secretary of State, von Weizsäcker, is attached to the Kaiser-Wilhelm-Institut in Berlin where some of the American work on uranium is now being repeated.

Yours very truly,

A. Einstein

(Albert Einstein)

These measurements of neutron emission by Fermi, Zinn, Szilard, Anderson, and Hanstein were highly significant steps toward a chain reaction.

Further impetus to the work on a uranium reactor was given by the discovery of plutonium at the Radiation Laboratory,* Berkeley, California, in March, 1940. This element, unknown in nature, was formed by uranium-238 capturing a neutron, and thence undergoing two successive changes in atomic structure with the emission of beta particles. Plutonium, it was believed, would undergo fission as did the rare isotope of uranium, ^{235}U.

Meanwhile, at Columbia, Fermi and Zinn and their associates were working to determine operationally possible designs of a uranium chain reactor. Among other things, they had to find a suitable moderating material to slow down the neutrons traveling at relatively high velocities. In July, 1941, experiments with uranium were started to obtain measurements of the reproduction factor (called "k"), which was the key to the problem of a chain reaction. If this factor could be made sufficiently greater than 1, a chain reaction could be made to take place in a mass of material of practical dimensions. If it were less than 1, no chain reaction could occur.

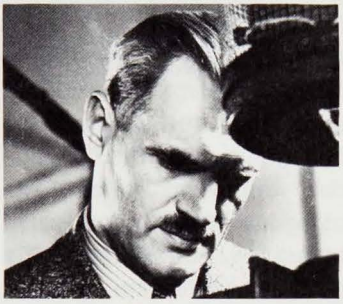
Since impurities in the uranium and in the moderator would capture neutrons and make them unavailable for further reactions, and since neutrons would escape from the pile without encountering uranium-235 atoms, it was not known whether a value for "k" greater than unity could ever be obtained.

Fortunate it was that the obtaining of a reproduction factor greater than 1 was a complex and difficult problem. If Hitler's scientists had discovered the secret of controlling the neutrons and had obtained a working value of "k," they would have been well on the way toward producing an atomic bomb for the Nazis.

*Now the E. O. Lawrence Radiation Laboratory, operated for the Atomic Energy Commission by the University of California.

The Cubical Lattice Concept

One of the first things that had to be determined was how best to place the uranium in the reactor. Fermi and Szilard suggested placing the uranium in a matrix of the moderating material, thus forming a cubical lattice of uranium. This placement appeared to offer the best opportunity for a neutron to encounter a uranium atom. Of all the materials which possessed the proper moderating qualities, graphite was the only one which could be obtained in sufficient quantity of the desired degree of purity.



Arthur H. Compton

The study of graphite–uranium lattice reactors was started at Columbia in July, 1941, but after reorganization of the uranium project in December, 1941, Arthur H. Compton was placed in charge of this phase of the work, under the Office of Scientific Research and Development, and it was decided that the chain reactor program should be concentrated at the University of Chicago. Consequently, early in 1942 the Columbia and Princeton groups were transferred to Chicago where the Metallurgical Laboratory* was established.

In a general way, the experimental nuclear physics group under Fermi was primarily concerned with getting a chain reaction going; the chemistry division organized by F. H. Spedding (later in turn under S. K. Allison, J. Franck, W. C. Johnson, and T. Hogness) with the chemistry of plutonium and with separation methods, and the theoretical group under E. P. Wigner with designing production piles. However, the problems were intertwined and the various scientific and technical aspects of the fission process were studied in whatever group seemed best equipped for the particular task.

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*The Metallurgical Laboratory was the predecessor of Argonne National Laboratory, which is operated for the Atomic Energy Commission by the University of Chicago and Argonne Universities Association.

At Chicago, the work on subcritical size piles was continued. By July, 1942, the measurements obtained from these experimental piles had gone far enough to permit a choice of design for a test pile of critical size. At that time, the dies for the pressing of the uranium oxides were designed by Zinn and ordered made. It was a fateful step, since the entire construction of the pile depended upon the shape and size of the uranium pieces.

It was necessary to use uranium oxides because metallic uranium of the desired degree of purity did not exist. Although several manufacturers were attempting to produce the uranium metal, it was not until November that any appreciable amount was available. By mid-November, Westinghouse Electric and Manufacturing Company, Metal Hydrides Company, and F. H. Spedding, who was working at Iowa State College at Ames, Iowa, had delivered several tons of the highly purified metal which was placed in the pile, as close to the center as possible. The procurement program for moderating material and uranium oxides had been handled by Norman Hilberry. R. L. Doan headed the procurement program for pure uranium metal.

Norman Hilberry

Although the dies for the pressing of the uranium oxides were designed in July, additional measurements were necessary to obtain information about controlling the reaction, to revise estimates as to the final critical size of the pile, and to develop other data. Thirty experimental subcritical piles were constructed before the final pile was completed.

The Manhattan District Formed

Leslie R. Groves

Meantime, in Washington, Vannevar Bush, Director of the Office of Scientific Research and Development, had recommended to President Roosevelt that a special Army Engineer organization be established to take full responsibility for the development of the atomic bomb. During the summer, the Manhattan Engineer District* was created, and in September, 1942, Major General L. R. Groves assumed command.

Construction of the main pile at Chicago started in November. The project gained momentum, with machining of the graphite blocks, pressing of the uranium oxide pellets, and the design of instruments. Fermi's two "construction" crews, one under Zinn and the other under Anderson, worked almost around the clock. V. C. Wilson headed up the instrument work.

Original estimates as to the critical size of the pile were pessimistic. As a further precaution, it was decided to enclose the pile in a balloon cloth bag which could be evacuated to remove the neutron-capturing air.

This balloon cloth bag was constructed by Goodyear Tire and Rubber Company. Specialists in designing gasbags for lighter-than-air craft, the company's engineers were a bit puzzled about the aerodynamics of a square balloon. Security regulations forbade informing Goodyear of the purpose of the envelope and so the Army's new square balloon was the butt of much joking.

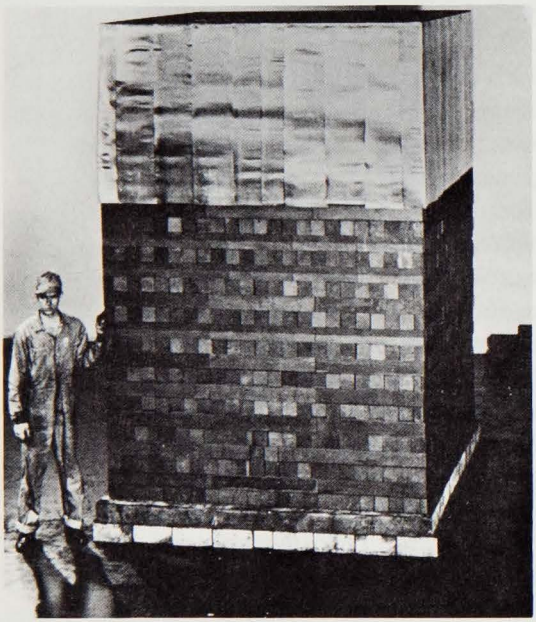
The bag was hung with one side left open; in the center of the floor a circular layer of graphite bricks was placed. This and each succeeding layer of the pile was braced by a wooden frame. Alternate layers contained the uranium.

*The Atomic Energy Commission (AEC), a civilian agency, succeeded the Manhattan Engineer District as the governmental organization to control atomic energy on January 1, 1947.

By this layer-on-layer construction a roughly spherical pile of uranium and graphite was formed.

Facilities for the machining of graphite bricks were installed in the West Stands. Week after week this shop turned out graphite bricks. This work was done under the direction of Zinn's group, by skilled mechanics led by millwright August Knuth. In October, Anderson and his associates joined Zinn's men.

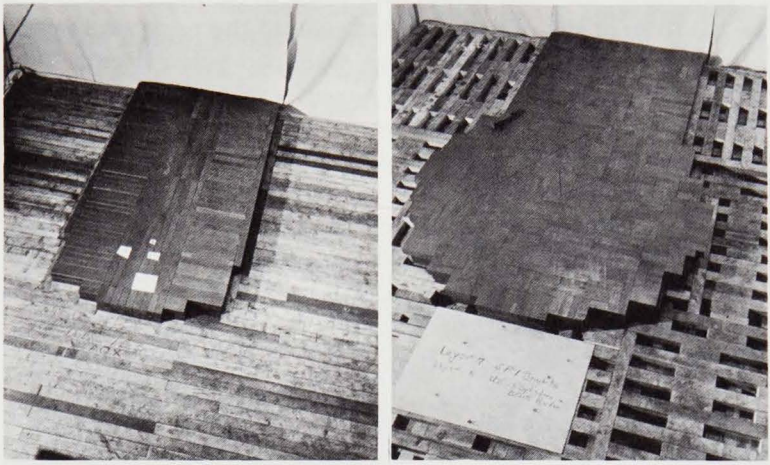
Describing this phase of the work, Albert Wattenberg, one of Zinn's group said: "We found out how coal miners feel. After eight hours of machining graphite, we looked as if we were made up for a minstrel. One shower would remove only the surface graphite dust. About a half-hour after the first shower the dust in the pores of your skin would start oozing. Walking around the room where we cut the graphite was like walking on a dance floor. Graphite is a dry lubricant, you know, and the cement floor covered with graphite dust was slippery."



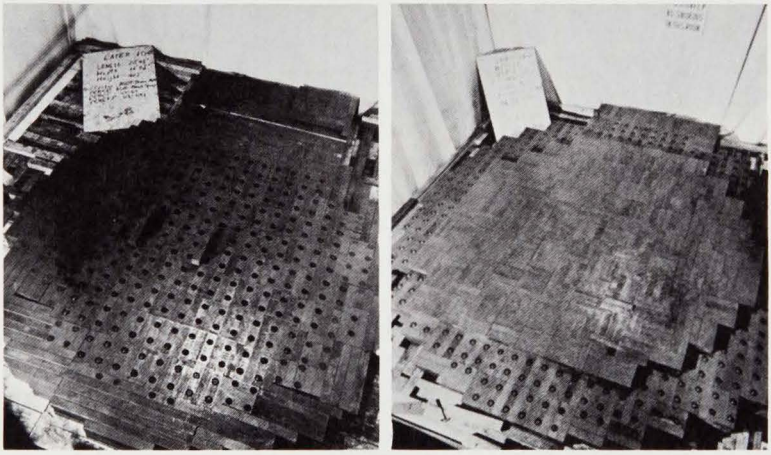
Robert G. Nobles stands next to one of the 30 piles built to furnish preliminary information necessary for the design of the first operating pile. The tops and sides were covered with cadmium sheets to eliminate errors by reducing the return of slow neutrons to the pile after scattering or reflection from the surroundings. A typical pile consisted of 30 layers of graphite with alternate layers bearing uranium fuel.

Before the structure was half complete, measurements indicated that the critical size at which the pile would become self-sustaining was somewhat less than had been anticipated in the design.

Construction of the Pile



Graphite layers form the base of the pile, left. On the right is the seventh layer of graphite and edges of 6th layer containing $3^1/_4$-inch pseudospheres of black uranium oxide. Beginning with layer 6, alternate courses of graphite containing uranium metal and/or uranium oxide fuel were separated by layers of solid graphite blocks.



Tenth layer of graphite blocks containing pseudospheres of black and brown uranium oxide. The brown briquets, slightly richer in uranium, were concentrated in the central area. In the foreground and on either side are cavities filled with graphite, now presumed to have been an expedient measure dictated by shortage of fuel and, possibly, a last minute change in the lattice arrangement. On the right is the nineteenth layer of graphite covering layer 18 containing slugs of uranium oxide.

Computations Forecast Success

Day after day the pile grew toward its final shape. And as the size of the pile increased, so did the nervous tension of the men working on it. Logically and scientifically they knew this pile would become self-sustaining. It had to. All the measurements indicated that it would. But still the demonstration had to be made. As the eagerly awaited moment drew nearer, the scientists gave greater and greater attention to details, the accuracy of measurements, and exactness of their construction work.

Guiding the entire pile construction and design was the nimble-brained Fermi, whose associates described him as "completely self-confident but wholly without conceit."

So exact were Fermi's calculations, based on the measurements taken from the partially finished pile, that days before its completion and demonstration on December 2nd, he was able to predict almost to the exact brick the point at which the reactor would become self-sustaining.

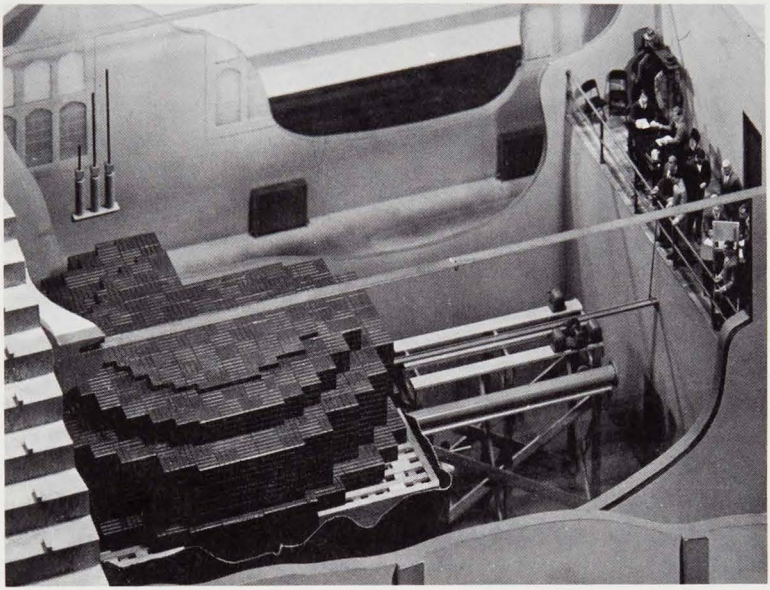
But with all their care and confidence, few in the group knew the extent of the heavy bets being placed on their success. In Washington, the Manhattan District had proceeded with negotiations with E. I. duPont de Nemours and Company to design, build, and operate a plant based on the principles of the then unproved Chicago pile. The $350,000,000 Hanford Engineer Works* at Pasco, Washington, was to be the result.

At Chicago during the early afternoon of December 1st, tests indicated that critical size was rapidly being approached. At 4:00 p.m. Zinn's group was relieved by the men working under Anderson. Shortly afterwards, the last layer of graphite and uranium bricks was placed on the pile. Zinn, who remained, and Anderson made several measurements of the activity within the pile. They were certain that when the control rods were withdrawn, the pile would become self-sustaining. Both had agreed, however, that should measurements indicate the reaction would become self-sustaining when the rods were withdrawn,

*Later the Hanford Atomic Products Operation—Hanford Laboratories, operated by the General Electric Co., for the AEC. Since 1965 Hanford facilities have been operated by 5 contractors.

they would not start the pile operating until Fermi and the rest of the group could be present. Consequently, the control rods were locked and further work was postponed until the following day.

That night the word was passed to the men who had worked on the pile that the trial run was due the next morning.



Cutaway model of the West Stands of Stagg Field showing the first pile in the squash court beneath it. The apparatus for withdrawing the emergency control rod "Zip" is in the center of the picture. A rope attached to the rod is tied to the rail of the balcony.

On the right are the West Stands.

Assembly for the Test

About 8:30 on the morning of Wednesday, December 2nd, the group began to assemble in the squash court.

At the north end of the squash court was a balcony about ten feet above the floor of the court. Fermi, Zinn, Anderson, and Compton were grouped around instruments at the east end of the balcony. The remainder of the observers crowded the little balcony. R. G. Nobles, one of the young scientists who worked on the pile, put it this way: "The control cabinet was surrounded by the 'big wheels'; the 'little wheels' had to stand back."

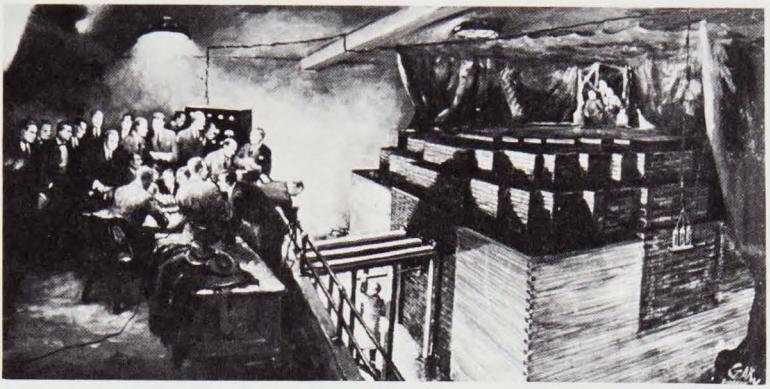
On the floor of the squash court, just beneath the balcony, stood George Weil, whose duty it was to handle the final control rod. In the pile were three sets of control rods. One set was automatic and could be controlled from the balcony. Another was an emergency safety rod. Attached to one end of this rod was a rope running through the pile and weighted heavily on the opposite end. The rod was withdrawn from the pile and tied by another rope to the balcony. Hilberry was ready to cut this rope with an axe should something unexpected happen, or in case the automatic safety rods failed. The third rod, operated by Weil, was the one which actually held the reaction in check until withdrawn the proper distance.

Since this demonstration was new and different from anything ever done before, complete reliance was not placed on mechanically operated control rods. Therefore, a "liquid-control squad," composed of Harold Lichtenberger, W. Nyer, and A. C. Graves, stood on a platform above the pile. They were prepared to flood the pile with cadmium-salt solution in case of mechanical failure of the control rods.

Each group rehearsed its part of the experiment.

At 9:45 Fermi ordered the electrically operated control rods withdrawn. The man at the controls threw the switch to withdraw them. A small motor whined. All eyes watched the lights which indicated the rods' position.

But quickly, the balcony group turned to watch the counters, whose clicking stepped up after the rods were out. The indicators of these counters resembled the face



of a clock, with "hands" to indicate neutron count. Nearby was a recorder, whose quivering pen traced the neutron activity within the pile.

Shortly after ten o'clock, Fermi ordered the emergency rod, called "Zip," pulled out and tied.

"Zip out," said Fermi. Zinn withdrew "Zip" by hand and tied it to the balcony rail. Weil stood ready by the "vernier" control rod which was marked to show the number of feet and inches which remained within the pile.

At 10:37 Fermi, without taking his eyes off the instruments, said quietly:

"Pull it to 13 feet, George." The counters clicked faster. The graph pen moved up. All the instruments were studied, and computations were made.

"This is not it," said Fermi. "The trace will go to this point and level off." He indicated a spot on the graph. In a few minutes the pen came to the indicated point and did not go above that point. Seven minutes later Fermi ordered the rod out another foot.

Again the counters stepped up their clicking, the graph pen edged upwards. But the clicking was irregular. Soon it leveled off, as did the thin line of the pen. The pile was not self-sustaining—yet.

At eleven o'clock, the rod came out another six inches; the result was the same: an increase in rate, followed by the leveling off.

Fifteen minutes later, the rod was further withdrawn and at 11:25 was moved again. Each time the counters

speeded up, the pen climbed a few points. Fermi predicted correctly every movement of the indicators. He knew the time was near. He wanted to check everything again. The automatic control rod was reinserted without waiting for its automatic feature to operate. The graph line took a drop, the counters slowed abruptly.

At 11:35, the automatic safety rod was withdrawn and set. The control rod was adjusted and "Zip" was withdrawn. Up went the counters, clicking, clicking, faster and faster. It was the clickety-click of a fast train over the rails. The graph pen started to climb. Tensely, the little group watched, and waited, entranced by the climbing needle.

Whrrrump! As if by a thunder clap, the spell was broken. Every man froze—then breathed a sigh of relief when he realized the automatic rod had slammed home. The safety point at which the rod operated automatically had been set too low.

"I'm hungry," said Fermi. "Let's go to lunch."

Time Out for Lunch

Perhaps, like a great coach, Fermi knew when his men needed a "break."

It was a strange "between halves" respite. They got no pep talk. They talked about everything else but the "game." The redoubtable Fermi, who never says much, had even less to say. But he appeared supremely confident. His "team" was back on the squash court at 2:00 p.m. Twenty minutes later, the automatic rod was reset and Weil stood ready at the control rod.

"All right, George," called Fermi, and Weil moved the rod to a predetermined point. The spectators resumed their watching and waiting, watching the counters spin, watching the graph, waiting for the settling down and computing the rate of rise of reaction from the indicators.

At 2:50 the control rod came out another foot. The counters nearly jammed, the pen headed off the graph paper. But this was not it. Counting ratios and the graph scale had to be changed.

"Move it six inches," said Fermi at 3:20. Again the change—but again the leveling off. Five minutes later,

Fermi called: "Pull it out another foot."

Weil withdrew the rod.

"This is going to do it," Fermi said to Compton, standing at his side. "Now it will become self-sustaining. The trace will climb and continue to climb. It will not level off."

Fermi computed the rate of rise of the neutron counts over a minute period. He silently, grim-faced, ran through some calculations on his slide rule.

First pile scientists at the University of Chicago on December 2, 1946, the fifth anniversary of their success. Back row, left to right, Norman Hilberry, Samuel Allison, Thomas Brill, Robert G. Nobles, Warren Nyer, and Marvin Wilkening. Middle row, Harold Agnew, William Sturm, Harold Lichtenberger, Leona W. Marshall, and Leo Szilard. Front row, Enrico Fermi, Walter H. Zinn, Albert Wattenberg, and Herbert L. Anderson.

In about a minute he again computed the rate of rise. If the rate was constant and remained so, he would know the reaction was self-sustaining. His fingers operated the slide rule with lightning speed. Characteristically, he turned the rule over and jotted down some figures on its ivory back.

Three minutes later he again computed the rate of rise in neutron count. The group on the balcony had by now crowded in to get an eye on the instruments, those behind craning their necks to be sure they would know the very instant history was made. In the background could be heard William Overbeck calling out the neutron count over an annunciator system. Leona Marshall (the only girl present), Anderson, and William Sturm were recording the readings from the instruments. By this time the click of the counters was too fast for the human ear. The clickety-click was now a steady brrrrr. Fermi, unmoved, unruffled, continued his computations.

The Curve is Exponential

"I couldn't see the instruments," said Weil. "I had to watch Fermi every second, waiting for orders. His face was motionless. His eyes darted from one dial to another. His expression was so calm it was hard. But suddenly, his whole face broke into a broad smile."

Fermi closed his slide rule—

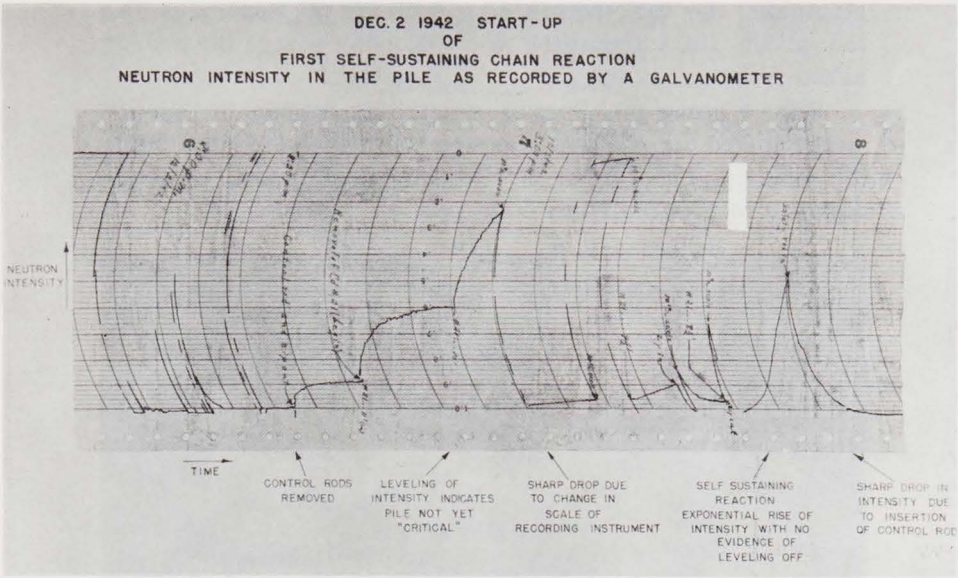
"The reaction is self-sustaining," he announced quietly, happily. "The curve is exponential."

The group tensely watched for twenty-eight minutes while the world's first nuclear chain reactor operated.

The upward movement of the pen was leaving a straight line. There was no change to indicate a leveling off. This was it.

"O.K., 'Zip' in," called Fermi to Zinn who controlled that rod. The time was 3:53 p.m. Abruptly, the counters slowed down, the pen slid down across the paper. It was all over.

Man had initiated a self-sustaining nuclear reaction—and then stopped it. He had released the energy of the atom's nucleus and controlled that energy.



The "birth certificate" of the Atomic Age. This graph indicates the neutron intensity as recorded by a galvanometer during various stages of the operation of the first pile.

Right after Fermi ordered the reaction stopped, the Hungarian-born theoretical physicist Eugene Wigner presented him with a bottle of Chianti wine. All through the experiment Wigner had kept this wine hidden behind his back.

Fermi uncorked the wine bottle and sent out for paper cups so all could drink. He poured a little wine in all the cups, and silently, solemnly, without toasts, the scientists raised the cups to their lips—the Canadian Zinn, the Hungarians Szilard and Wigner, the Italian Fermi, the Americans Compton, Anderson, Hilberry, and a score of others. They drank to success—and to the hope they were the first to succeed.

Eugene P. Wigner

A small crew was left to

straighten up, lock controls, and check all apparatus. As the group filed from the West Stands, one of the guards asked Zinn:

"What's going on, Doctor, something happen in there?"

The guard did not hear the message which Arthur Compton was giving James B. Conant at Harvard, by long-distance telephone. Their code was not prearranged.

The Chianti bottle that Eugene Wigner brought to celebrate the first self-sustaining chain reaction. Many of the scientists autographed the basket. Fermi's signature is just below the label.

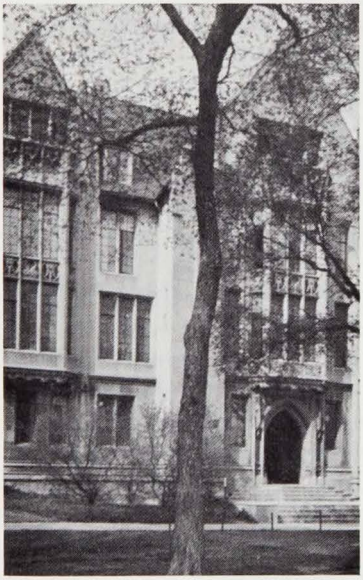
"The Italian navigator has landed in the New World," said Compton.

"How were the natives?" asked Conant.

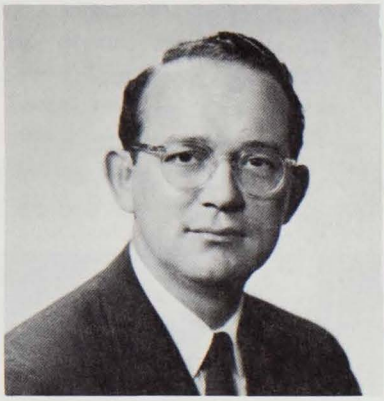
"Very friendly."

List of Those Present At CHICAGO PILE EXPERIMENT December 2, 1942

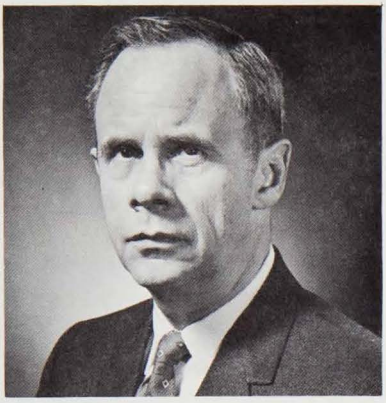
H. M. Agnew
S. K. Allison
H. L. Anderson
W. Arnold
H. M. Barton
T. Brill
R. F. Christy
A. H. Compton
Enrico Fermi
R. J. Fox
S. A. Fox
D. K. Froman
A. C. Graves
C. H. Greenewalt
N. Hilberry
D. L. Hill
W. H. Hinch
W. R. Kanne
P. G. Koontz
H. E. Kubitschek
H. V. Lichtenberger
G. Miller
G. Monk, Jr.
R. G. Nobles
W. E. Nyer
W. P. Overbeck
H. J. Parsons
G. S. Pawlicki
L. Sayvetz
L. Seren
L. A. Slotin
F. H. Spedding
W. J. Sturm
Leo Szilard
A. Wattenberg
R. J. Watts
G. L. Weil
E. P. Wigner
M. Wilkening
V. C. Wilson
Miss L. Woods
W. H. Zinn



The "Council Tree" beneath which scientists held a highly secret discussion in April 1942 that was vital to the success of the first pile. It stands in front of Eckhart Hall on the University of Chicago campus. The meeting was held outdoors so the scientists could talk freely without being overheard.



Corbin Allardice



Edward R. Trapnell

These two men wrote *The First Pile* in 1946 while they were engaged in public information duties for the Manhattan Project, the military agency that was succeeded January 1, 1947, by the Atomic Energy Commission. Mr. Allardice was then on the Manhattan Project Staff, and Mr. Trapnell was civilian public relations adviser to the commander.

Later Mr. Allardice served in the AEC Public Information Service in Washington, and as Information Director and Special Assistant to the Manager, New York Operations Office of the AEC. Thereafter he was successively Executive Director of the Joint Congressional Committee on Atomic Energy, adviser on nuclear power to the International Bank for Reconstruction and Development, a member of the project steering committee for the Garogliano Nuclear Power Station in Italy, and Assistant Director of Marketing for the World Bank in New York. Although totally disabled by illness, he now works as a writer, and is preparing a book about the Atomic Energy Commission, with Mr. Trapnell again as his coauthor.

Mr. Trapnell served as Associate Director of the AEC Public and Technical Information Service for 5 years, then served as Special Assistant to the AEC General Manager, with responsibilities for Congressional relations. Thereafter he was with the International Atomic Energy Agency in Vienna for 2 years, and Special Assistant for Public Affairs to the Secretary of the Air Force for 3 years. He now is a consultant on resource development in Washington, primarily concerned with promotion of the NAWAPA concept for continental water resource development.

Authors' Note

This story was written in the fall of 1946 because nowhere in the extensive records of the Plutonium Project was there a narrative history of the first self-sustaining nuclear chain reaction. Prepared for a press release by the Manhattan Engineer District, in other words for journalistic, not scientific, purposes, the report includes background material which is properly a part of a report on a very important experiment.

It occurred to us that the story of the experiment which was successfully completed on December 2nd, 1942, was of such significance that it should be written down while still relatively fresh in the minds of those who took part. What we have written was constructed from the personal recollections of more than a dozen of the 42 scientists present in the Stagg Field squash court on December 2nd. Another valuable source of information was the tape on which was traced the neutron intensity within the first pile.

The appended list of those present was obtained from the label of a bottle in which Dr. E. P. Wigner had brought Chianti wine to toast the experiment's success. Most of those present had signed the wine-bottle's label and given it to Dr. A. Wattenberg as a memento. This was the only written record of who had taken part in the experiment. Each of the scientists listed on the bottle was asked if he recalled any others who might have been present, and the resulting list of 42 names was accepted as complete.

The two drawings of the first pile were executed by Melvin A. Miller of the Argonne National Laboratory staff in the fall of 1946. They are based on descriptions given Mr. Miller by the men who built the first "pile."

We wish to thank Drs. H. L. Anderson, A. H. Compton, E. Fermi, N. Hilberry, H. V. Lichtenberger, L. W. Marshall, R. G. Nobles, W. J. Sturm, A. Wattenberg and W. H. Zinn for their assistance.

That what we have written is a worthwhile story of December 2nd, is due to them; the inaccuracies or omissions are ours.

Corbin Allardice
November 17, 1949 Edward R. Trapnell

FERMI'S OWN STORY*

By Enrico Fermi

It is ten years since man first achieved a self-sustaining atomic reaction.

Many people link this event only with the development of the atomic bomb and the subsequent efforts to develop the hydrogen bomb, reference to which has been made in the last few days by the Atomic Energy Commission.

The history of the first self-sustaining nuclear chain reaction, like that of all scientific achievements, begins with man's first philosophical speculations about the nature of the universe. Its ultimate consequences are still unpredictable.

The sequence of discoveries leading to the atomic chain reaction was part of the search of science for a fuller explanation of nature and the world around us. No one had any idea or intent in the beginning of contributing to a major industrial or military development.

A partial list of the main stepping-stones to this development indicates many countries contributed to it.

A. H. Becquerel

The story begins in Paris in 1896 when Antoine Henri Becquerel discovered the existence of radioactive elements; that is, elements which spontaneously emit invisible, penetrating rays. Two years later, also in Paris, Pierre and Marie Curie discovered radium, for many years the best known of the radioactive elements.

In Zurich, Switzerland, in 1905, Albert Einstein announced his belief that mass was equivalent to energy. This led to speculation that one could be transformed into the other.

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*Written by Dr. Fermi and published in the *Chicago Sun-Times*, November 23, 1952, in observance of the tenth anniversary of Fermi's successful "First Pile" experiment. Copyright by the *Chicago Sun-Times*. Reprinted by permission.

Ernest Rutherford

A most important discovery came in 1912 when Ernest Rutherford discovered the minute but heavy nucleus which forms the core of the atom. In ordinary elements this core is stable; in radioactive elements it is unstable.

Shortly after World War I, the same Rutherford achieved for the first time the artificial disintegration of the nucleus at the center of the nitrogen atom.

During the next decade, research progressed steadily, if unspectacularly. Then, in 1932, came a series of three discoveries by scientists working in three different countries which led to the next great advance.

Walter Bothe in Germany, and Frederic Joliot-Curie in Paris prepared the groundwork that led James Chadwick of England to the discovery of the neutron. The neutron is an electrically neutral building block of the nuclear structure. The other building block is the positively charged proton.

The next step was taken in Rome in 1934. In experiments in which I was concerned it was shown that these neutrons could disintegrate many atoms, including those of uranium. This discovery was to be directly applied in the first atomic chain reaction eight years later.

The Discovery of Fission

The final stepping-stone was put in place in Berlin when Otto Hahn, working with Fritz Strassman, discovered fission or splitting of the uranium atom. When Hahn achieved fission, it occurred to many scientists that this fact opened the possibility of a form of nuclear (atomic) energy.

The year was 1939. A world war was about to start. The new possibilities appeared likely to be important, not only for peace but also for war.

A group of physicists in the United States—including Leo Szilard, Walter Zinn, now director of Argonne National Laboratory, Herbert Anderson, and myself—agreed pri-

vately to delay further publications of findings in this field.

We were afraid these findings might help the Nazis. Our action, of course, represented a break with scientific tradition and was not taken lightly. Subsequently, when the government became interested in the atom bomb project, secrecy became compulsory.

Here it may be well to define what is meant by the "chain reaction" which was to constitute our next objective in the search for a method of utilizing atomic energy.

An atomic chain reaction may be compared to the burning of a rubbish pile from spontaneous combustion. In such a fire, minute parts of the pile start to burn and in turn ignite other tiny fragments. When sufficient numbers of these fractional parts are heated to the kindling points, the entire heap bursts into flames.

A similar process takes place in an atomic pile such as was constructed under the West Stands of Stagg Field at the University of Chicago in 1942.

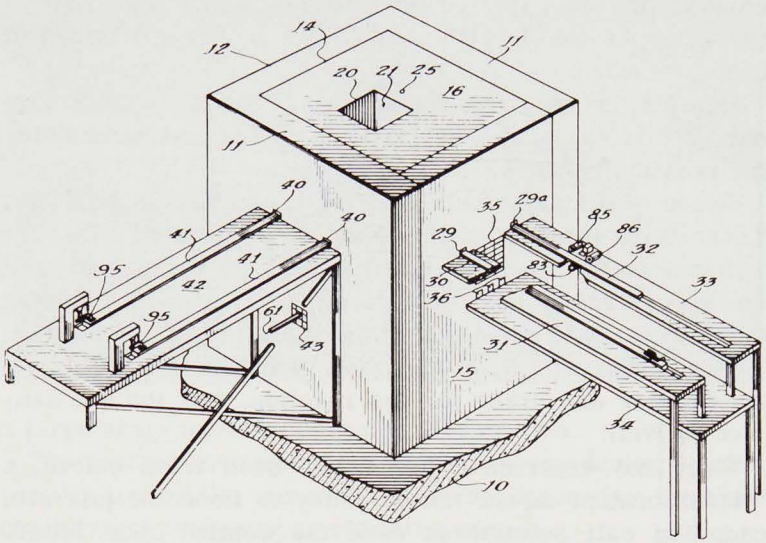
The pile itself was constructed of uranium, a material that is embedded in a matrix of graphite. With sufficient uranium in the pile, the few neutrons emitted in a single fission that may accidentally occur strike neighboring atoms, which in turn undergo fission and produce more neutrons.

These bombard other atoms and so on at an increasing rate until the atomic "fire" is going full blast.

The atomic pile is controlled and prevented from burning itself to complete destruction by cadmium rods which absorb neutrons and stop the bombardment process. The same effect might be achieved by running a pipe of cold water through a rubbish heap; by keeping the temperature low the pipe would prevent the spontaneous burning.

The first atomic chain reaction experiment was designed to proceed at a slow rate. In this sense it differed from the atomic bomb, which was designed to proceed at as fast a rate as was possible. Otherwise, the basic process is similar to that of the atomic bomb.

The atomic chain reaction was the result of hard work by many hands and many heads. Arthur H. Compton, Walter Zinn, Herbert Anderson, Leo Szilard, Eugene Wigner and many others worked directly on the problems at the Uni-



Patent No. 2,708,656 was issued on May 18, 1955 to Enrico Fermi and Leo Szilard. The invention it covers includes the first nuclear reactor, Chicago Pile No. 1 (CP-1). Although the patent was applied for in December 1944, it could not be issued until years later when all the secret information it contained was made public. This drawing was in the patent application.

versity of Chicago. Very many experiments and calculations had to be performed. Finally a plan was decided upon.

Thirty "piles" of less than the size necessary to establish a chain reaction were built and tested. Then the plans were made for the final test of a full-sized pile.

The scene of this test at the University of Chicago would have been confusing to an outsider—if he could have eluded the security guards and gained admittance.

He would have seen only what appeared to be a crude pile of black bricks and wooden timbers. All but one side of the pile was obscured by a balloon cloth envelope.

As the pile grew toward its final shape during the days of preparation, the measurement performed many times a day indicated everything was going, if anything, a little bit better than predicted by calculations.

The Gathering on the Balcony

Finally the day came when we were ready to run the experiment. We gathered on a balcony about 10 feet above the floor of the large room in which the structure had been erected.

Beneath us was a young scientist, George Weil, whose duty it was to handle the last control rod that was holding the reaction in check.

Every precaution had been taken against an accident. There were three sets of control rods in the pile. One set was automatic. Another consisted of a heavily weighted emergency safety held by a rope. Walter Zinn was holding the rope ready to release it at the least sign of trouble.

The last rod left in the pile, which acted as starter, accelerator and brake for the reaction, was the one handled by Weil.

Since the experiment had never been tried before, a "liquid control squad" stood ready to flood the pile with cadmium salt solution in case the control rods failed. Before we began, we rehearsed the safety precautions carefully.

Finally, it was time to remove the control rods. Slowly Weil started to withdraw the main control rod. On the balcony, we watched the indicators which measured the neutron count and told us how rapidly the disintegration of the uranium atoms under their neutron bombardment was proceeding.

At 11:35 a.m., the counters were clicking rapidly. Then, with a loud clap, the automatic control rods slammed home. The safety point had been set too low.

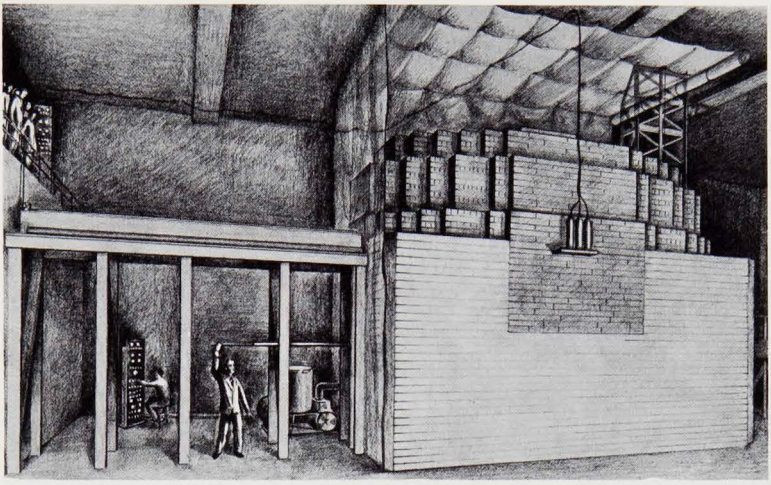
It seemed a good time to eat lunch.

During lunch everyone was thinking about the experiment but nobody talked much about it.

At 2:30 Weil pulled out the control rod in a series of measured adjustments.

Shortly after, the intensity shown by the indicators began to rise at a slow but ever-increasing rate. At this moment we knew that the self-sustaining reaction was under way.

The event was not spectacular, no fuses burned, no lights flashed. But to us it meant that release of atomic energy on



a large scale would be only a matter of time.

The further development of atomic energy during the next three years of the war was, of course, focused on the main objective of producing an effective weapon.

At the same time we all hoped that with the end of the war emphasis would be shifted decidedly from the weapon to the peaceful aspects of atomic energy.

We hoped that perhaps the building of power plants, production of radioactive elements for science and medicine would become the paramount objectives.

Unfortunately, the end of the war did not bring brotherly love among nations. The fabrication of weapons still is and must be the primary concern of the Atomic Energy Commission.

Secrecy that we thought was an unwelcome necessity of the war still appears to be an unwelcome necessity. The peaceful objectives must come second, although very considerable progress has been made also along those lines.

The problems posed by this world situation are not for the scientist alone but for all people to resolve. Perhaps a time will come when all scientific and technical progress will be hailed for the advantages that it may bring to man, and never feared on account of its destructive possibilities.

OF SECRECY AND THE PILE*

By Laura Fermi

The period of great secrecy in our life started when we moved to Chicago. Enrico walked to work every morning. Not to the physics building, nor simply to the "lab," but to the "Met. Lab.," the Metallurgical Laboratory. Everything was top secret there. I was told one single secret: there were no metallurgists at the Metallurgical Laboratory. Even this piece of information was not to be divulged. As a matter of fact, the less I talked, the better; the fewer people I saw outside the group working at the Met. Lab., the wiser I would be.

In the fall Mr. and Mrs. Arthur H. Compton—I was to learn later that he was in charge of the Metallurgical Project—gave a series of parties for newcomers at the Metallurgical Laboratory. Newcomers were by then so numerous that not even in Ida Noyes Hall, the students' recreation hall, was there a room large enough to seat them all at once; so they were invited in shifts. At each of these parties the English film *Next of Kin* was shown. It depicted in dark tones the consequences of negligence and carelessness. A briefcase laid down on the floor in a public place is stolen by a spy. English military plans become known to the enemy. Bombardments, destruction of civilian homes, and an unnecessary high toll of lives on the fighting front are the result.

After the film there was no need for words.

Willingly we accepted the hint and confined our social activities to the group of "metallurgists." Its always expanding size provided ample possibilities of choice; besides, most of them were congenial, as was to be expected, for they were scientists.

The nonworking wives wished, quite understandably, to do something for the war effort. One of the possible activities along this line was to help entertain the armed forces at the USO. I preferred to sew for the Red Cross or to work

*From *Atoms in the Family*, Laura Fermi, University of Chicago Press, Chicago, Illinois, 1954. Copyright by the University of Chicago Press. Reprinted by permission.

Laura and Enrico Fermi

as a volunteer in the hospital of the university, and to save my social capacities for the people at the Met. Lab., who had not the benefit of the USO.

The Fermis' Party

Thus early in December, 1942, I gave a large party for the metallurgists who worked with Enrico and for their wives. As the first bell rang shortly after eight in the evening, Enrico went to open the door, and I kept a few steps behind him in the hall. Walter Zinn and his wife Jean walked in, bringing along the icy-cold air that clung to their clothes. Their teeth chattered. They shook the snow from their shoulders and stamped their feet heavily on the floor to reactivate the circulation in limbs made numb by the subzero weather. Walter extended his hand to Enrico and said:

"Congratulations."

"Congratulations?" I asked, puzzled, "What for?" Nobody took any notice of me.

Enrico was busy hanging Jean's coat in the closet, and both the Zinns were fumbling at their snow boots with sluggish fingers.

"Nasty weather," Jean said, getting up from her bent position to put her boots in a corner. Walter again stamped his feet noisily on the floor.

"Won't you come into the living room?" Enrico asked. Before we had time to sit down, the bell rang again; again Enrico went to open the door, and amid repeated stamping of feet and complaints about the extraordinarily cold weather I again heard a man's voice:

"Congratulations."

It went on this same way until all our guests had arrived. Every single man congratulated Enrico. He accepted the congratulations readily, with no embarrassment or show of modesty, with no words, but with a steady grin on his face.

My inquiries received either no answer at all or such evasive replies as: "Ask your husband," or: "Nothing special. He is a smart guy. That's all," or: "Don't get excited. You'll find out sometime."

I had nothing to help me guess. Enrico had mentioned nothing worthy of notice, and nothing unusual had happened, except, of course, the preparations for the party. And those did not involve Enrico and provided no ground for congratulating.

I had cleaned house all morning; I had polished silver. I had picked up the electric train in Giulio's room and the books in Nella's. If there is a formula to teach order to children, I have not found it. I had run the vacuum, dusted, and sighed. All along I was making calculations in my mind:

"Half an hour to set the table. Half an hour to spread sandwiches. Half an hour to collect juices for the punch. . . . I must remember to make tea for my punch soon, so that it will have time to cool. . . . And if people start coming by eight, we'll have to start dressing by seven-thirty, and eating dinner by. . . ." So I had calculated my afternoon schedule backward from the time the company would arrive up to when I should set myself to work.

A Homemaker's Schedule

My schedule was upset, as schedules will be. While I was baking cookies in the kitchen, the house had gone surprisingly quiet, too quiet to contain Giulio and his two girl friends who had come to play. Where were they? Into what sort of mischief had they got themselves? I found them on the third-floor porch. The three angelic-looking little children were mixing snow with the soil in the flower pots and throwing balls at our neighbor's recently washed windows. Precious time was spent in scolding and punishing, in seeing what could be done to placate our neighbor.

So at dinner time Enrico found me hurrying through the last preparations, absorbed in my task and even less than usually inclined to ask questions of him. We rushed through dinner, and then I realized we had no cigarettes. It was not unusual: we don't smoke, and I always forget to buy them.

"Enrico, wouldn't you run to the drugstore for cigarettes?" I asked. The answer was what I expected, what it had been on other such occasions:

"I don't know how to buy them."

"We can't do without cigarettes for our guests," I insisted, as I always did; "it isn't done."

"We'll set the habit, then. Besides, the less our company smokes, the better. Not so much foul smell in the house tomorrow."

This little act was almost a ritual performed before each party. There was nothing unusual in it, nor in Enrico's behavior. Then why the congratulations?

Leona Woods

I went up to Leona Woods, a tall young girl built like an athlete, who could do a man's job and do it well. She was the only woman physicist in Enrico's group. At that time her mother, who was also endowed with inexhaustible energy, was running a small farm near Chicago almost by herself. To relieve Mrs. Woods of some work, Leona

divided her time and her allegiance between atoms and potatoes. Because I refused either to smash atoms or to dig potatoes, she looked down on me. I had been at the Woods's farm, however, and had helped with picking apples. Leona, I thought, owed me some friendliness.

"Leona, be kind. Tell me what Enrico did to earn these congratulations."

Sinking an Admiral

Leona bent her head, covered with short, deep-black hair, toward me, and from her lips came a whisper:

"He has sunk a Japanese admiral."

"You are making fun of me," I protested.

Herbert L. Anderson

But Herbert Anderson came to join forces with Leona. Herbert, the boy who had been a graduate student at Columbia University when we arrived in the United States, had taken his Ph. D. work with Enrico and was still working with him. He had come to Chicago a few months before I did.

"Do you think anything is impossible for Enrico?" he asked me with an earnest, almost chiding, face.

No matter how firmly the logical part of my mind did disbelieve, there still was another, way back, almost in the subconscious, that was fighting for acceptance of Leona's and Herbert's words. Herbert was Enrico's mentor. Leona, who was young enough to have submitted to intelligence tests in her recent school days, was said to have a spectacular I.Q. They should know. To sink a ship in the Pacific from Chicago . . . perhaps power rays were discovered . . . .

When a struggle between two parts of one's mind is not promptly resolved with clear outcome, doubt results. My doubt was to last a long time.

That evening no more was said about admirals. The party proceeded as most parties do, with a great deal of small

talk around the punch bowl in the dining room; with comments on the war in the living room; with games of ping-pong and shuffleboard on the third floor, because Enrico has always enjoyed playing games, and most of our guests were young.

In the days that followed I made vain efforts to clear my doubts.

"Enrico, did you really sink a Japanese admiral?"

"Did I?" Enrico would answer with a candid expression.

"So you did not sink a Japanese admiral!"

"Didn't I?" His expression would not change.

Two years and a half elapsed. One evening, shortly after the end of the war in Japan, Enrico brought home a mimeographed, paperbound volume.

"It may interest you to see the Smyth Report,"* he said. "It contains all declassified information on atomic energy. It was just released for publication, and this is an advance copy."

It was not easy reading. I struggled with its technical language and its difficult content until slowly, painfully, I worked my way through it. When I reached the middle of the book, I found the reason for the congratulations Enrico had received at our party. On the afternoon of that day, December 2, 1942, the first chain reaction was achieved and the first atomic pile operated successfully, under Enrico's direction. Young Leona Woods had considered this feat equivalent to the sinking of an admiral's ship with the admiral inside. The atomic bomb still lay in the womb of the future, and Leona could not foresee Hiroshima.

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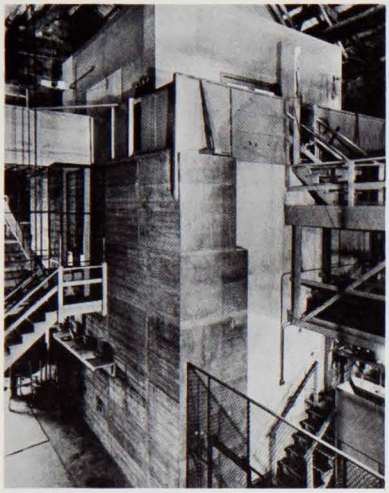
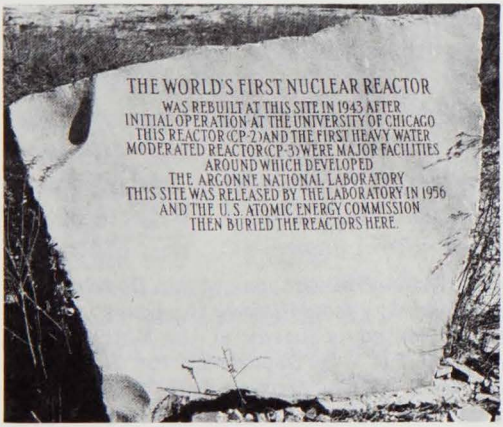
*This classic document, *A General Account of the Development of Methods of Using Atomic Energy for Military Purposes*, written by Henry D. Smyth, who directed research at the Metallurgical Laboratory, was released by the War Department on August 12, 1945. (It later was published, with a shorter title, by Princeton University Press. See Suggested References.)



The first pile was disassembled early in 1943 and rebuilt with certain refinements and modifications near the present site of the Argonne National Laboratory. It was renamed Chicago Pile No. 2 (CP-2).

Unveiling of the plaque on the West Stands on the occasion of the fifth anniversary, December 2, 1947. Left to right are AEC Commissioners William W. Waymack and Robert F. Bacher, Farrington Daniels, Walter H. Zinn, Enrico Fermi, and R. M. Hutchins, Chancellor of the University of Chicago. (The West Stands were demolished in 1957, but the plaque remains at the site.)



The first heavy water moderated reactor (CP-3) was built near CP-2. In 1956 the uranium, graphite, and heavy water from the two reactors were removed and the remaining shells buried beneath this marker.

PERSONS PRESENT AT CP-1 EXPERIMENT

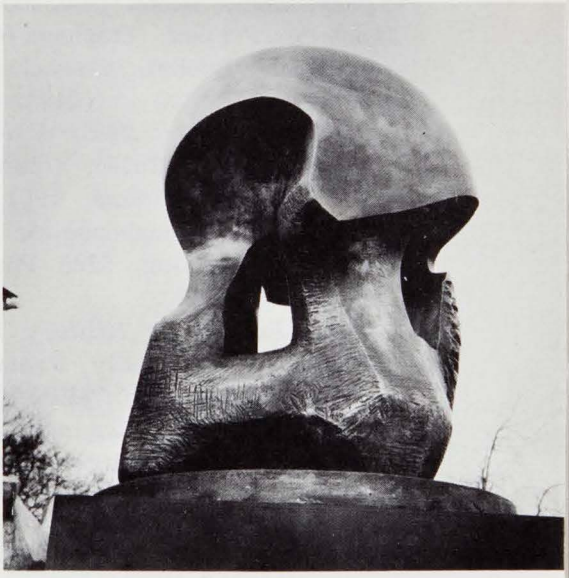
Achievement of First Self-Sustained Nuclear Chain Reaction

December 2, 1942

Dr. Harold M. Agnew*
Professor Samuel K. Allison*
Professor Herbert L. Anderson
Wayne Arnold†
Hugh M. Barton, Jr.*
Thomas Brill*
Dr. R. F. Christy
Arthur H. Compton†
Enrico Fermi†
Richard J. Fox*
Stewart Fox*
Dr. Carl C. Gamertsfelder*
Dr. Alvin C. Graves*
Dr. Crawford Greenewalt*
Dr. David L. Hill*
Dr. Norman Hilberry*
William H. Hinch*
Robert E. Johnson*
W. R. Kanne*
August C. Knuth
P. G. Koontz*
Dr. Herbert E. Kubitschek
Harold V. Lichtenberger*
George M. Maronde*
Dr. Leona Woods Marshall (Mrs.)
Anthony J. Matz
George Miller*
George D. Monk*
Dr. Henry W. Newson
Robert G. Nobles*
Warren E. Nyer*
Wilcox P. Overbeck*
Howard Parsons*
Dr. Gerard S. Pawlicki*
Theodore Petry*
David R. Rudolph
Leon Sayvetz*
Dr. Leo Seren
Louis Slotin†
Dr. Frank H. Spedding
Dr. William J. Sturm*
Dr. Leo Szilard
Dr. Albert Wattenberg
R. J. Watts*
George L. Weil*
Dr. Eugene P. Wigner
Dr. Marvin H. Wilkening
Dr. Volney C. Wilson*
Dr. Walter H. Zinn*

* Present this Evening
† Deceased

Signatures obtained during 20th anniversary programs at the American Nuclear Society—Atomic Industrial Forum Meeting, Washington, D. C., November 27, 1962, and at the University of Chicago, December 1, 1962.



Model of a work of sculpture by Henry Moore, who was commissioned by the University of Chicago to create a work to commemorate the "Birth of the Atomic Age". The sculpture was prepared for dedication for the 25th anniversary of the first pile.

SUGGESTED REFERENCES

Books

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The cover painting depicts the scene of December 2, 1942, when the first nuclear reactor achieved a self-sustaining chain reaction. The original painting, executed in 1957 by Gary Sheahan, Chicago Tribune Staff Artist, after 4 months of research, is now owned by the Chicago Historical Society.

PHOTO CREDITS

Cover courtesy Chicago Tribune (copyright 1957)
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Page

5	Addison-Wesley Publishing Company
6	Nobel Institute
7	Louise Barker (left); Ike Verne
8	U. S. Army
8-9	Franklin D. Roosevelt Library
9	Johan Hagemeyer
11	Stephen Deutsch
13	*Chicago Sun-Times*
19	*Chicago Tribune*
23	Nobel Institute (bottom)
28	Mary Elvira Weeks, *Discovery of the Elements*, Journal of Chemical Education
29	Nobel Institute
41	University of Chicago (bottom)

This booklet is one of the "Understanding the Atom" Series. Comments are invited on this booklet and others in the series; please send them to the Division of Technical Information, U. S. Atomic Energy Commission, Washington, D. C. 20545.

Published as part of the AEC's educational assistance program, the series includes these titles:

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Students and teachers who need other material on specific aspects of nuclear science, or references to other reading material, may also write to the Oak Ridge address. Requests should state the topic of interest exactly, and the use intended.

In all requests, include "Zip Code" in return address.

Printed in the United States of America

USAEC Division of Technical Information Extension, Oak Ridge, Tennessee

November 1967

You are cordially invited to attend a special dinner

in observance of

THE TWENTY-FIFTH ANNIVERSARY OF THE FIRST NUCLEAR CHAIN REACTION

on Saturday, December 2, 1967

The University of Chicago · Hutchinson Commons

57th Street and South University Avenue

Reception / 5:30 P.M.
Dinner / 6:30 P.M.

The favor of a reply is requested

The première of a 30-minute motion picture, "The Day Tomorrow Began," will take place at 8:30 p.m. in Mandel Hall, adjacent to Hutchinson Commons

You are cordially invited to view

CHICAGO'S HOMAGE TO HENRY MOORE

An exhibition of his sculpture and drawings, presented by the
Renaissance Society at The University of Chicago and
the Committee for the 25th Anniversary
Observance of the First Nuclear Chain Reaction, on the occasion
of the unveiling of Mr. Moore's sculpture,
"Nuclear Energy."

PREVIEW NOVEMBER 30, 1967, 3:00 P.M. TO 5:00 P.M.

Exhibition may be viewed Monday through Saturday,
9:00 A.M. to 5:00 P.M., December 1 through December 22,
at the School of Social Service Administration Building,
969 East 60th Street, Chicago, Illinois.

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THE UNIVERSITY OF CHICAGO

Requests the honor of your presence

at the unveiling ceremonies for

"NUCLEAR ENERGY"

A specially commissioned work of sculpture

by HENRY MOORE

In observance of the

25th Anniversary of the First Nuclear Chain Reaction

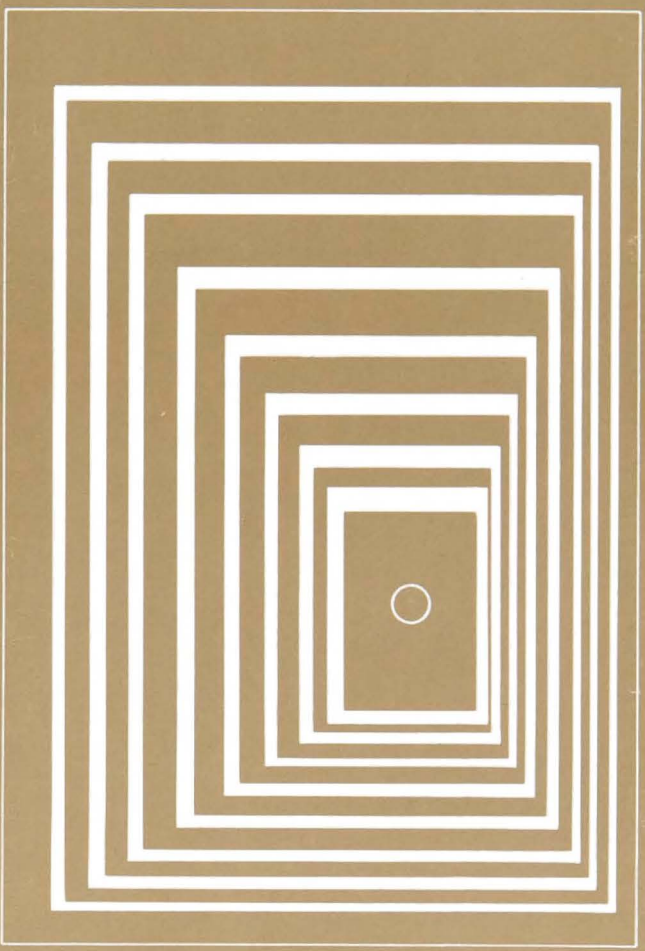
On Saturday, December 2, 1967

Unveiling Ceremony / 3:00 p.m. / 5635 South Ellis Avenue

Henry Moore Exhibition

4:00 p.m. / High Energy Physics Building, 933 East 56th Street

THE UNIVERSITY OF CHICAGO
CENTER FOR CONTINUING EDUCATION



Focus on Knowledge

The University of Chicago Campus and Midway

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Conference rooms and Guest rooms are designed to provide maximum Guest comfort.

Private and public dining rooms, cafeteria and cocktail lounge available to Guests.

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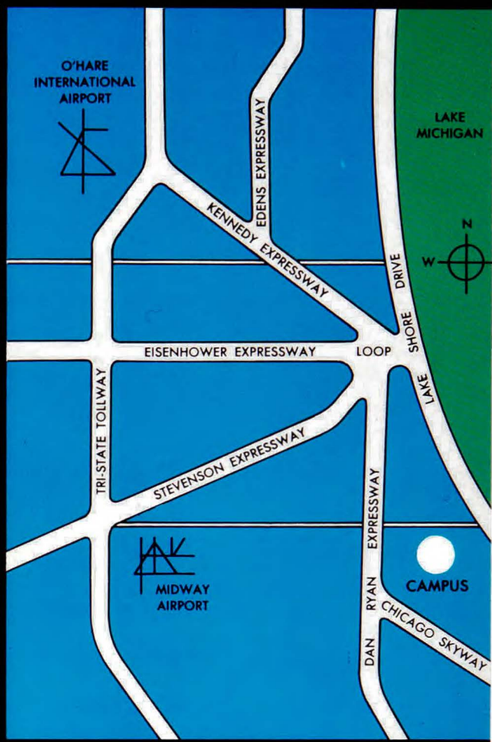
at the edge of Lake Michigan
THE CAMPUS



The air-conditioned Center for Continuing Education has 118 guest rooms, each with twin beds and private bath. Meals may be eaten in the Center's cafeteria or in its elegant dining room. Private dining facilities are available for group meals. Off street parking is available behind the Center.

Ten conference rooms and an auditorium provide space for groups ranging in size from 20 to 400. Complete audio-visual services can satisfy all taping, transcription and projection needs. Printing and mailing services and duplicating machines are also available to all conference groups.

A library has standard reference works for use by all conferees.

Staff members of the Center for Continuing Education are available to assist in every phase of a conference. These coordinators are trained to advise in planning, budget preparation, instructional aids, publications, and post-conference evaluation. They will also handle the physical arrangements of a conference.

Amid the Neo-Gothic architecture which dominates the campus, the Center for Continuing Education strikes a modern but harmonious note. It is the only Chicago work of the famous American architect, Edward Durrell Stone.

The conference center provides a setting for the University of Chicago to:

- translate basic research findings into practical programs of national and international importance.
- inform the nation's leaders and policy makers of the relevance of University research and teaching to national needs and problems.
- initiate programs of instruction for practicing specialists in a wide variety of areas, and
- train graduate students in continuing education and increase knowledge of the processes by which such programs can be made more effective.

A symbolic "Red Carpet for New Ideas" has always been unrolled at The University of Chicago. The University itself was a new idea when it opened its doors in 1892. Set in the midst of the nation's second largest metropolitan area, the University has maintained an ideal academic atmosphere. Work on the 125-acre campus does not turn in onto itself: it is oriented to the world beyond it's boundaries and the world has come to expect a constant flow of new ideas from its classrooms, offices, laboratories, and libraries. Ideas on the campus serve as a catalyst not only for those who pursue knowledge for it's own sake, but also for those whose interests range to the pragmatic and practical in the various levels of our complex modern society.

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1307 East 60th Street
CHICAGO, ILLINOIS 60637
BUtterfield 8-2500 — Area Code 312

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Cocktail Lounge: Opens 11:30 A.M. daily and 12 noon on Sundays

You will help the staff to expedite service if you wear your badge at all times. In conformity with University practice, guests customarily wear coats and ties in the dining rooms. Coats mandatory after 5:30 P.M.

Checkout time is 3:00 P.M. If you wish to check your luggage beyond this time there are lockers adjacent to the public telephones on the first floor.

Valet Service: Laundry and dry cleaning taken to the front desk before 9:00 A.M. will be returned next morning. There is no delivery on Sundays.

Library: Standard reference works may be found in the library on the second floor.

Conference Lounge: When not in use by a group meeting, visitors may view television in this room on the second floor across from the library. There is another TV set in the 3d Floor N.W. Corridor.

News stand: As well as newspapers, periodicals and books, you may buy cigarettes and a selection of personal items—combs, razor blades, playing cards, aspirin, etc. The nearest **Drug Store** is at 57th Street and Kenwood Avenue, three short blocks to the north of the building's front entrance. The nearest **Barber Shop** is in the International House, across the Midway Plaisance and one block east. Arrange appointments by calling FA 4-8200.

The Hotel Desk will be pleased to provide transportation assistance, maps and information about the campus. The staff will be glad to keep your valuables; otherwise we cannot be responsible for their safety.

Transport, Parking, etc.: Chicago transit maps are available free at the hotel desk. There is parking for cars behind the building.

Telephones: The switchboard (BUtterfield 8-2500) operates 24 hours a day. There are public telephones in the lobbies leading to the car park.

No deliveries from package liquor stores will be accepted by the Center or its staff. No pets allowed.

Your Room has been furnished with a radio set. The Chicago frequencies of the more important broadcasters are:

ABC	**890**
CBS	**780**
NBC	**670**
WGN	**720**

The temperature controls of your room are at the window. Push down the back of the plates to open. The one on the right sets the temperature, the one on the left controls the speed of the fan. In warm weather the fan should be kept at Medium or High. Your air will be better and cleaner if you keep the windows closed at all times.

The Games Room downstairs (Room 15) provides facilities for chess, bridge, etc. An athletic privilege card for swimming, etc., may be had free on application to Bartlett Gymnasium. See campus map, available at Hotel Desk.

You will find in the campus map information about the famous Oriental Institute Museum.

You may also like to visit the Museum of Science and Industry at E. 57th Street and South Shore Drive, which has many fascinating exhibits. Admission to both museums is free.

Tours of the city can be arranged by the Emery-Drexel Limousine Co. (663-1220). Charges are $4.50 per hour. They are also available for ordinary taxi service to the Loop and transportation points.

Detail from figure 7: "A Negro boy Jimmy's age by Ruby at age 6"

From *Children In Crisis* by Dr. Robert Coles. Little Brown and Company, Boston, 1967.

THE CHICAGO INSTITUTE FOR EARLY CHILDHOOD EDUCATION

The Chicago Institute for Early Childhood Education is a professional training institute for teachers and administrators for nursery schools, kindergarten, and day care centers.

It was established in response to one of the major concerns of the nation, its culturally deprived children.

Government and private institutions have initiated a nationwide effort to reach these children, and to provide them with those early skills which are the foundation for primary education. A severe limitation of this effort, however, is the shortage of trained nursery school teachers. The purpose of CIECE is to provide for teachers and supervisors in this field; to train them well enough so that they in turn may teach others.

CIECE is the first privately endowed institution which prepares women exclusively for pre-kindergarten teaching.

DR. ROBERT COLES

Dr. Robert Coles is Research Psychiatrist of Harvard University Health Service. He has served on the staffs of Massachusetts General Hospital, McLean Hospital and the Children's Hospital of Boston.

An active participant in the civil rights movement, he brings to it the expert knowledge of the social psychiatrist. It was in this role that he appeared on the National Education Television program, "The Way It Is," His articulate and perceptive analysis of that remarkable film received great critical acclaim.

He is the author of the recently published book "Children in Crisis," a detailed and fascinating study of the children, black and white, involved in the desegregation of Southern schools. He has written widely for many publications, including the Atlantic, Harpers, New Yorker, Saturday Review and The New Republic.

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YOUNG CHILDREN IN CRISIS

Reservations at $5.50 must be made in advance. Remittance card enclosed.

CAMPAIGN FOR CHICAGO

The University of Chicago is in the midst of a major three-year campaign to seek the sum of $160,000,000 for its further growth and development.

The "Campaign for Chicago" is the largest fund drive for a private university over such a time span in the history of American education. Launched on October 20, 1965, the Campaign so far has met with an encouraging response from alumni, parents of students, and other individual friends of the University. Private foundations and the business community have also made generous contributions.

THE UNIVERSITY OF CHICAGO CAMPUS MAP

RESEARCH FACILITIES

The Enrico Fermi Institute for Nuclear Studies (B-3), 5640 Ellis Avenue. Research is carried on in the following fields: study of nuclei and nuclear reaction, study of meteorites, geology and cosmogony, experimental nuclear physics, elementary particle physics, cosmic-ray studies, theoretical physics, and magnetic resonance studies of atomic and molecular structure. A 450 million electron volt synchrocyclotron is just part of the scientific equipment used in this research.

The Laboratory for Astrophysics and Space Research (B-3), Ingleside Avenue and 56th Street, concentrates primarily on theoretical and experimental astrophysics. Providing facilities for ground-based investigation and satellite experiments in space, the Laboratory trains space-oriented scientists.

Institute for the Study of Metals (B-3), 5640 Ellis Avenue, conducts research into the basic physics of metals and other solids. A liquid-helium plant provides the essential facility to carry these studies to very low temperatures.

The Institute for Computer Research (B-3), 5640 Ellis Avenue, constructs and operates advanced types of high-speed electronic computers and investigates the principles and techniques of logical design.

Health Information Foundation (A-4), 5555 Ellis Avenue, collects, interprets, and distributes data related to the social and economic (non-clinical) aspects of medical care to assist in improving the health of the American people.

The Industrial Relations Center (F-7), in the Charles Stewart Mott Building, 1225 East 60th Street, furnishes services used by major corporations for research and education in industrial relations, labor management relations, and labor economics.

The National Opinion Research Center (F-3), 6030 Ellis Avenue, specializes in research in the social sciences and surveys public attitudes and reaction in the United States.

The Computation Center (B-3), 5640 Ellis Avenue, a multimillion dollar installation, is designed to provide the most modern computer services to the entire faculty for a wide variety of academic disciplines and inquiries.

The Institute for International Studies coordinates international academic programs at the University.

In addition, there are scores of research facilities and centers incorporated in the operations of the college, the divisions, and the professional schools. The Center for Policy Study conducts seminars concerned with domestic and international issues.

SPECIAL FACILITIES

The University of Chicago Medical Center (D-2-3), 950 East 59th Street, includes: Philip D. Armour Clinical Research Building, Albert Merritt Billings Hospital, Bobs Roberts Memorial Hospital, Chicago Lying-in Hospital, Chronic Disease Hospital, Nathan Goldblatt Memorial Hospital, Goldblatt Pavilion, Home for Destitute Crippled Children, Charles Gilman Smith Hospital, the Silvain and Arma Wyler Children's Hospital, and Argonne Cancer Research Hospital (operated for the United States Atomic Energy Commission). Tours of the Medical Center leave the outpatient admitting desk, Wednesdays, at 12:00 M.

Harper Memorial Library (D-4-5), 1116 East 59th Street, and the 18 departmental libraries house over 2,500,000 volumes. Harper is especially rich in works of the social sciences, modern languages and literatures.

The Oriental Institute (D-6), 1155 East 58th Street, was founded in 1919 by James Breasted. Its faculty has made excavations in every country in the Near East. The Institute Museum houses one of the world's most extensive collections of Near Eastern art and archeological findings, including Dead Sea scroll fragments, cloth scroll wrappings, and a scroll jar, and traces man's history back to the Stone Age. The Institute also operates Chicago House in Luxor, Egypt. The Museum is open Tuesdays–Sundays, 10:00 A.M.–5:00 P.M., closed Mondays and holidays. Guided tours may be arranged. Phone: MIdway 3-0800, ext. 2474.

The Laboratory Schools (D-8), 1362 East 59th Street, founded by John Dewey, developed in The University of Chicago nursery, elementary, and high schools many of the educational advances later adopted by schools throughout the country, and continue a vigorous program of investigation and testing.

The Sonia Shankman Orthogenic School (F-9), 1365 East 60th Street, is a coeducational residential treatment institution devoted to the study and rehabilitation of emotionally disturbed children of potentially normal or superior intelligence and to the training of graduate students and professionals who wish to specialize in the treatment of such children.

University Extension offers a wide variety of courses and special programs for those who are not regular degree students of the University. At the Downtown Center, 65 East South Water Street, special non-credit courses for adults are offered. On the campus, credit courses in the afternoons, evenings, and on Saturdays are open to the public. The Extension Division also operates the Center for Continuing Education (F-8) which houses conferences and special residential courses. The air-conditioned Center, designed by Edward Durell Stone, affords an opportunity for academic and professional organizations to meet in the most modern conference setting.

OFF-CAMPUS FACILITIES

Argonne National Laboratory, Argonne, Illinois, is 26.1 miles southwest of the Quadrangles and is operated by the University for the United States Atomic Energy Commission. It is one of the world's leading research centers on peaceful uses of nuclear energy. The Laboratory occupies 3,700 acres and employs 1,300 scientists and engineers and 3,500 supporting personnel. Organized into 16 scientific divisions, through the Associated Midwest Universities (AMU) with headquarters at Argonne, it maintains academic and scientific relationships in research with the 31-member AMU universities. Its vast range of scientific facilities includes the $42,000,000 Zero Gradient Synchrotron, a 12.5 billion electron volt atom smasher which is one of the nation's most powerful instruments. Tours may be arranged. Phone: 739-7711.

Yerkes Observatory, 76 miles north of Chicago at Williams Bay, Wisconsin, is devoted to research in astronomy and astrophysics and to graduate instruction. Its principal instrument is a 40-inch refracting telescope. Visiting hours Saturday only: Winter (Oct. 1–May 31), lecture 10:00 A.M.–12:00 M. (CST or DST); Summer (June 1–Sept. 30), lectures at 1:30, 2:15, 3:00 P.M. (DST). Free. Large groups must provide advance notice. Phone: Lake Geneva, CIrcle 5-5555.

McDonald Observatory, Fort Davis, Texas, is operated jointly by The University of Chicago and the University of Texas, with Chicago providing the scientific staff. One outstanding feature is McDonald's 82-inch reflector telescope.

La Rabida–University of Chicago Institute, specializing in children's disease research, is affiliated with the Medical Center. Its near-campus address is East 65th Street and South Shore Drive. Phone: DO 3-6700.

HISTORY

The University of Chicago is a privately supported, nondenominational, coeducational institution of higher learning and research. It offers undergraduate, graduate, postdoctoral, and professional study.

The University was founded by John D. Rockefeller in 1891. Classes began in 1892 with 594 students and 103 faculty members.

Today, students come from every state in the Union and 71 foreign countries. A total of 7,782 students enrolled on the Quadrangle in the Autumn Quarter, 1965: 2,325 were undergraduates, 5,208 graduates, and 248 special students. More than 500 came from abroad.

The full-time faculty numbers 1,035. In addition, there are about 760 research associates, lecturers, field workers, consultants, visiting lecturers, and teachers in the University's nursery, elementary, and high schools.

The University has awarded a total of 93,502 degrees and the Alumni Association maintains records of some 73,000 living alumni. More than 160 past and present college and university presidents throughout the world have been students or teachers at The University of Chicago.

The University of Chicago has had seven chief executives:

William Rainey Harper	—1891–1906
Harry Pratt Judson	—1907–1923
Ernest DeWitt Burton	—1923–1925
Max Mason	—1925–1928
Robert Maynard Hutchins	—1929–1951
Lawrence A. Kimpton	—1951–1960
George Wells Beadle	—1961——

Mr. Beadle, a geneticist, is one of the 27 Nobel prize winners who have been associated with the University. On the faculty are 29 members of the National Academy of Sciences, 19 members of the American Philosophical Society, and 38 Fellows of the American Academy of Arts and Sciences.

The University of Chicago has the fourth largest endowment among private universities in the United States: $275,000,000 (market value), June, 1966.

Today, Chicago's main campus covers 150 acres and includes 125 buildings along both sides of the Midway Plaisance.

ACADEMIC PROGRAM
General

Incorporated within the University are the College, the four Divisions, the seven Graduate Schools, and six Institutes. More than forty departments and twenty-two interdepartmental committees function within this framework. The campus budget totals more than $90,000,000 annually.

From its beginning, The University of Chicago has placed equal emphasis on research and teaching, and has exerted a profound influence on higher education in America.

The University's traditional encouragement of independent thought and investigation attracts a faculty of international distinction as well as a student body with the highest potential for learning and leadership. In pursuing its objectives, the University also has made a significant contribution to the practice and theory of higher education in this country. Its innovations include equal educational opportunities for women at all levels, introduction of the junior college concept, extensive courses in liberal arts, the four-quarter system, a full-time medical staff, new standards for social service administration, and the integration of general education requirements in undergraduate programs.

ACADEMIC PROGRAM
The College

The four-year *College*, small, selective, and largely residential, is an integral part of The University of Chicago. The College has its own dean and a faculty of 300, and is organized into five Collegiate Divisions under five Masters. Programs leading to the bachelor's degree in the five Divisions are: Biological Sciences, Humanities, Physical Sciences, Social Sciences and interdisciplinary studies. In a study made by the National Academy of Sciences–National Research Council, it was found that the production index of doctorates earned between 1936 and 1956 per 1,000 graduates of the College was higher than that of any other college in the United States. In 1966, 20 College seniors were awarded Woodrow Wilson Fellowships.

ACADEMIC PROGRAM
Professional Graduate

The Graduate School of Business is the second oldest of its kind in the country. The School offers an M.B.A. and a Ph.D. program on the Quadrangles in addition to two evening M.B.A. programs at 190 East Delaware Place. The Downtown Program is designed for businessmen and includes a special two-year Executive Program.

The Divinity School, which has educated more doctoral students than any other such school in America, is interdenominational in both faculty and student body. Established as the University's first professional school, its primary purpose is to engage in disciplined theological research and inquiry into the nature and task of the Christian faith, educating future professors and ministers alike.

The Graduate School of Education provides a focal point for training scholar-teachers, educational administrators, and researchers. Members of the faculty conduct research into all the facets of the learning and teaching processes, frequently working closely with faculties of other departments such as sociology, psychology, and anthropology. The School also directs the activities of the Laboratory Schools and the Sonia Shankman Orthogenic School. (See "Special Facilities.")

The Law School is noted for the eminence of its faculty, its traditional concern with the relationships between law and the other social sciences, the rigor of its professional training, and its close relationship with the bench and the bar. Actual court sessions held in the School's Weymouth Kirkland Courtroom are a regular part of the professional curriculum. Its striking building (F-5), 1121 East 60th Street, was designed by the late architect Eero Saarinen.

The Graduate Library School was the first library school in the United States to offer advanced research study leading to the Ph.D. degree. Reflecting the view that libraries are social agencies bringing together a great variety of books, information, and readers, the School's curriculum centers around the problems of bibliography, interpretation, selection, communication, and library administration. The School is cognizant, in its course offerings, of the influence of recent research in the information and communications sciences, and includes "information retrieval" and "data processing application."

The School of Medicine, which admits 72 students annually, is America's only medical school with a completely full-time faculty. Members of the staff do not have outside private practices, but devote their time exclusively to the care of patients, teaching and research in the University's hospitals and clinics. More than 600 doctors and scientists work here in one of the world's most renowned medical centers. The School places special emphasis on the scientific basis of medicine and on the skillful application of scientific principles to human problems.

The School of Social Service Administration (F-3), 969 East 60th Street, is widely known for its pioneering work in social service reform, its scientific studies of social problems, and its leadership in social work education and practice. It is one of the oldest graduate schools of social work in the country. Its new building was designed by Ludwig Mies van der Rohe.

ACADEMIC PROGRAM
Graduate

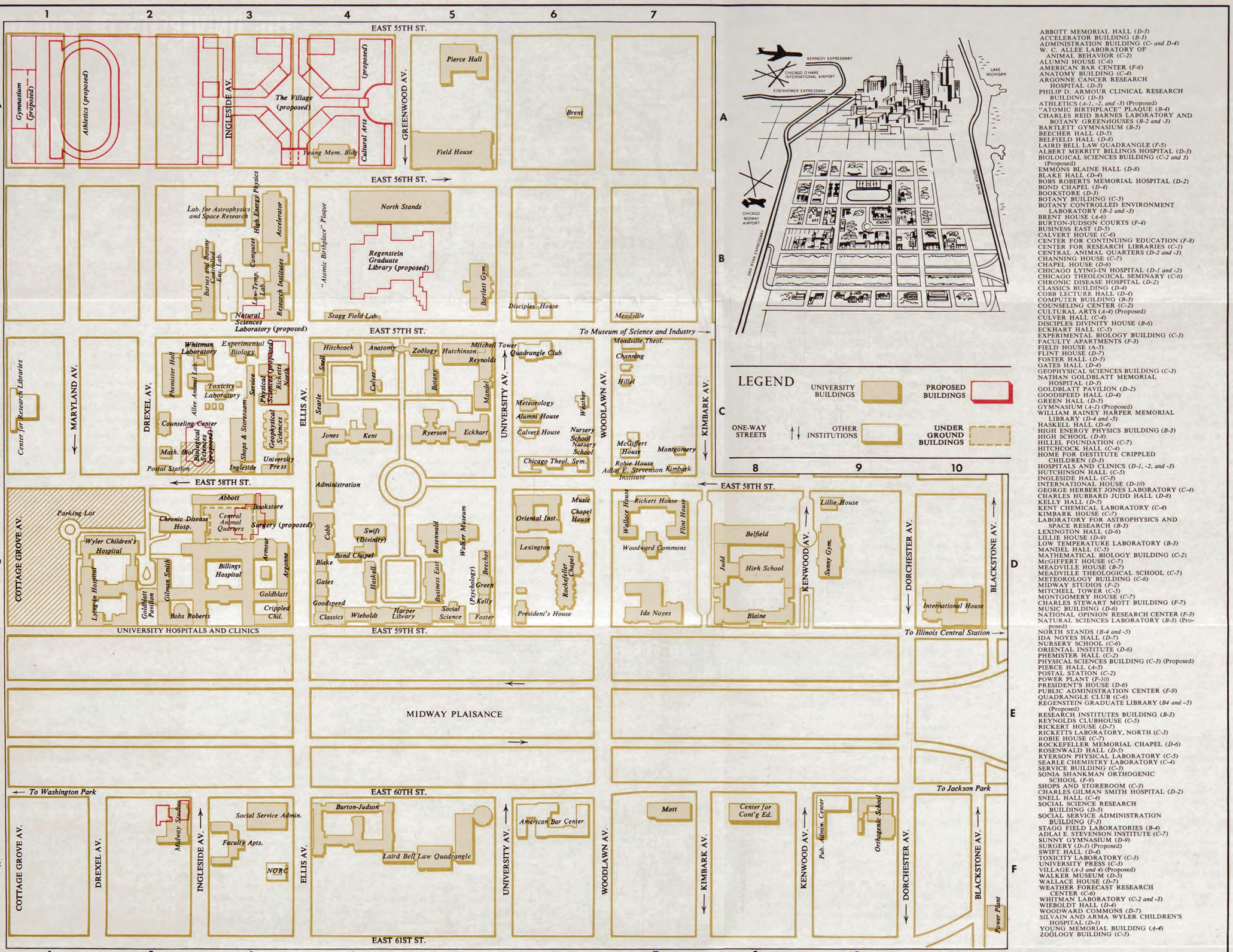
THE DIVISIONS

Biological Sciences include the following areas of study: Anatomy, Biochemistry, Biophysics, Botany, Medicine, Microbiology, Obstetrics and Gynecology, Pathology, Pediatrics, Pharmacology, Physiology, Psychiatry, Radiology, Surgery, Zoölogy, Genetics, Mathematical Biology, Virology, Paleozoölogy, Biopsychology, and Biostatistics. The University's School of Medicine with its hospitals, clinics, and laboratories forms an integral part of the Division.

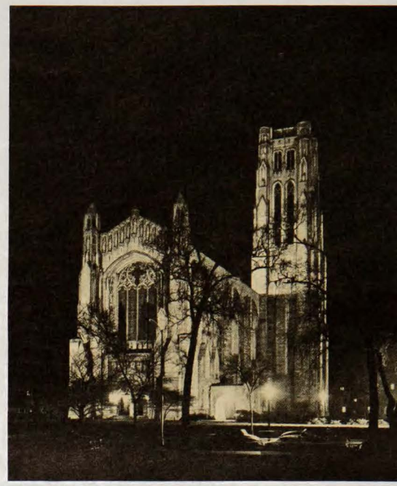
Humanities include the following areas of study: Art, Classical Languages and Literatures, English Language and Literature, Germanic Languages and Literatures, History, Linguistics, Music, New Testament and Early Christian Literature, Oriental Languages and Civilizations, Philosophy, Romance Languages and Literatures, Slavic Languages and Literatures, General Studies in the Humanities, Comparative Studies in Literature, History of Culture, Analysis of Ideas and Study of Methods, Far Eastern Civilizations, African Studies, Near Eastern Studies, Archeological Studies, Medieval Studies, and Slavic and Balkan Studies.

Physical Sciences include the following areas of study: Astronomy and Astrophysics, Chemistry, Geography, Geophysical Sciences, Mathematics, Physics, Statistics. The Division of the Physical Sciences also incorporates the Institute for Computer Research, the Institute for the Study of Metals, and the Enrico Fermi Institute for Nuclear Studies and its Laboratory for Astrophysics and Space Research.

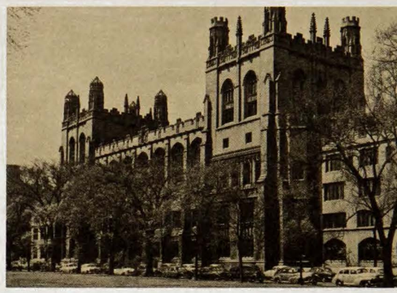
Social Sciences include the following areas of study: Anthropology, Economics, Education, Geography, History, Political Science, Psychology, Sociology, Statistics, Far Eastern Civilizations, Human Development, International Relations, Industrial Relations, Social Thought, Comparative Study of New Nations, Southern Asian Studies, African Studies, Near Eastern Studies, Urban Studies, and Slavic Area Studies.



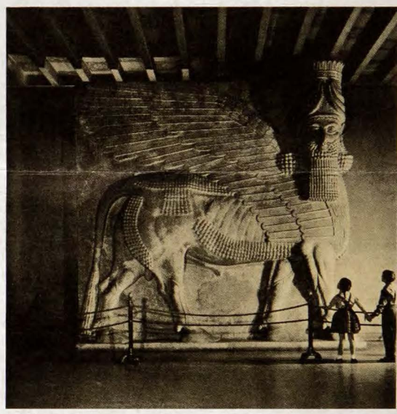
ABBOTT MEMORIAL HALL (*D-3*)
ACCELERATOR BUILDING (*B-3*)
ADMINISTRATION BUILDING (*C- and D-4*)
W. C. ALLEE LABORATORY OF ANIMAL BEHAVIOR (*C-2*)
ALUMNI HOUSE (*C-6*)
AMERICAN BAR CENTER (*F-6*)
ANATOMY BUILDING (*C-4*)
ARGONNE CANCER RESEARCH HOSPITAL (*D-3*)
PHILIP D. ARMOUR CLINICAL RESEARCH BUILDING (*D-3*)
ATHLETICS (*A-1, -2, and -3*) (Proposed)
"ATOMIC BIRTHPLACE" PLAQUE (*B-4*)
CHARLES REID BARNES LABORATORY AND BOTANY GREENHOUSES (*B-2 and -3*)
BARTLETT GYMNASIUM (*B-5*)
BEECHER HALL (*D-5*)
BELFIELD HALL (*D-8*)
LAIRD BELL LAW QUADRANGLE (*F-5*)
ALBERT MERRITT BILLINGS HOSPITAL (*D-3*)
BIOLOGICAL SCIENCES BUILDING (*C-2 and 3*) (Proposed)
EMMONS BLAINE HALL (*D-8*)
BLAKE HALL (*D-4*)
BOBS ROBERTS MEMORIAL HOSPITAL (*D-2*)
BOND CHAPEL (*D-4*)
BOOKSTORE (*D-3*)
BOTANY BUILDING (*C-5*)
BOTANY CONTROLLED ENVIRONMENT LABORATORY (*B-2 and -3*)
BRENT HOUSE (*A-6*)
BURTON-JUDSON COURTS (*F-4*)
BUSINESS EAST (*D-5*)
CALVERT HOUSE (*C-6*)
CENTER FOR CONTINUING EDUCATION (*F-8*)
CENTER FOR RESEARCH LIBRARIES (*C-1*)
CENTRAL ANIMAL QUARTERS (*D-2 and -3*)
CHANNING HOUSE (*C-7*)
CHAPEL HOUSE (*D-6*)
CHICAGO LYING-IN HOSPITAL (*D-1 and -2*)
CHICAGO THEOLOGICAL SEMINARY (*C-6*)
CHRONIC DISEASE HOSPITAL (*D-2*)
CLASSICS BUILDING (*D-4*)
COBB LECTURE HALL (*D-4*)
COMPUTER BUILDING (*B-3*)
COUNSELING CENTER (*C-2*)
CULTURAL ARTS (*A-4*) (Proposed)
CULVER HALL (*C-4*)
DISCIPLES DIVINITY HOUSE (*B-6*)
ECKHART HALL (*C-5*)
EXPERIMENTAL BIOLOGY BUILDING (*C-3*)
FACULTY APARTMENTS (*F-3*)
FIELD HOUSE (*A-5*)
FLINT HOUSE (*D-7*)
FOSTER HALL (*D-5*)
GATES HALL (*D-4*)
GEOPHYSICAL SCIENCES BUILDING (*C-3*)
NATHAN GOLDBLATT MEMORIAL HOSPITAL (*D-3*)
GOLDBLATT PAVILION (*D-2*)
GOODSPEED HALL (*D-4*)
GREEN HALL (*D-5*)
GYMNASIUM (*A-1*) (Proposed)
WILLIAM RAINEY HARPER MEMORIAL LIBRARY (*D-4 and -5*)
HASKELL HALL (*D-4*)
HIGH ENERGY PHYSICS BUILDING (*B-3*)
HIGH SCHOOL (*D-8*)
HILLEL FOUNDATION (*C-7*)
HITCHCOCK HALL (*C-4*)
HOME FOR DESTITUTE CRIPPLED CHILDREN (*D-3*)
HOSPITALS AND CLINICS (*D-1, -2, and -3*)
HUTCHINSON HALL (*C-5*)
INGLESIDE HALL (*C-3*)
INTERNATIONAL HOUSE (*D-10*)
GEORGE HERBERT JONES LABORATORY (*C-4*)
CHARLES HUBBARD JUDD HALL (*D-8*)
KELLY HALL (*D-5*)
KENT CHEMICAL LABORATORY (*C-4*)
KIMBARK HOUSE (*C-7*)
LABORATORY FOR ASTROPHYSICS AND SPACE RESEARCH (*B-3*)
LEXINGTON HALL (*D-6*)
LILLIE HOUSE (*D-9*)
LOW TEMPERATURE LABORATORY (*B-3*)
MANDEL HALL (*C-5*)
MATHEMATICAL BIOLOGY BUILDING (*C-2*)
McGIFFERT HOUSE (*C-7*)
MEADVILLE HOUSE (*B-7*)
MEADVILLE THEOLOGICAL SCHOOL (*C-7*)
METEOROLOGY BUILDING (*C-6*)
MIDWAY STUDIOS (*F-2*)
MITCHELL TOWER (*C-5*)
MONTGOMERY HOUSE (*C-7*)
CHARLES STEWART MOTT BUILDING (*F-7*)
MUSIC BUILDING (*D-6*)
NATIONAL OPINION RESEARCH CENTER (*F-3*)
NATURAL SCIENCES LABORATORY (*B-3*) (Proposed)
NORTH STANDS (*B-4 and -5*)
IDA NOYES HALL (*D-7*)
NURSERY SCHOOL (*C-6*)
ORIENTAL INSTITUTE (*D-6*)
PHEMISTER HALL (*C-2*)
PHYSICAL SCIENCES BUILDING (*C-3*) (Proposed)
PIERCE HALL (*A-5*)
POSTAL STATION (*C-2*)
POWER PLANT (*F-10*)
PRESIDENT'S HOUSE (*D-6*)
PUBLIC ADMINISTRATION CENTER (*F-9*)
QUADRANGLE CLUB (*C-6*)
REGENSTEIN GRADUATE LIBRARY (*B4 and –5*) (Proposed)
RESEARCH INSTITUTES BUILDING (*B-3*)
REYNOLDS CLUBHOUSE (*C-5*)
RICKERT HOUSE (*D-7*)
RICKETTS LABORATORY, NORTH (*C-3*)
ROBIE HOUSE (*C-7*)
ROCKEFELLER MEMORIAL CHAPEL (*D-6*)
ROSENWALD HALL (*D-5*)
RYERSON PHYSICAL LABORATORY (*C-5*)
SEARLE CHEMISTRY LABORATORY (*C-4*)
SERVICE BUILDING (*C-3*)
SONIA SHANKMAN ORTHOGENIC SCHOOL (*F-9*)
SHOPS AND STOREROOM (*C-3*)
CHARLES GILMAN SMITH HOSPITAL (*D-2*)
SNELL HALL (*C-4*)
SOCIAL SCIENCE RESEARCH BUILDING (*D-5*)
SOCIAL SERVICE ADMINISTRATION BUILDING (*F-3*)
STAGG FIELD LABORATORIES (*B-4*)
ADLAI E. STEVENSON INSTITUTE (*C-7*)
SUNNY GYMNASIUM (*D-9*)
SURGERY (*D-3*) (Proposed)
SWIFT HALL (*D-4*)
TOXICITY LABORATORY (*C-3*)
UNIVERSITY PRESS (*C-3*)
VILLAGE (*A-3 and 4*) (Proposed)
WALKER MUSEUM (*D-5*)
WALLACE HOUSE (*D-7*)
WEATHER FORECAST RESEARCH CENTER (*C-6*)
WHITMAN LABORATORY (*C-2 and -3*)
WIEBOLDT HALL (*D-4*)
WOODWARD COMMONS (*D-7*)
SILVAIN AND ARMA WYLER CHILDREN'S HOSPITAL (*D-1*)
YOUNG MEMORIAL BUILDING (*A-4*)
ZOOLOGY BUILDING (*C-5*)



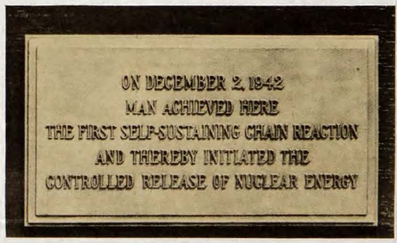
Rockefeller Chapel



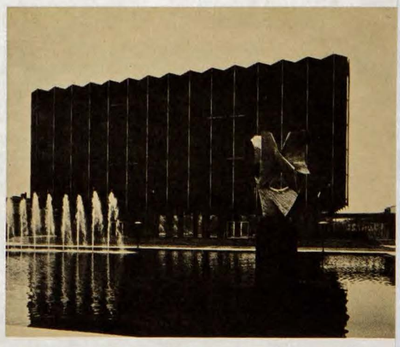
Harper Library



Oriental Institute, Winged Bull



"Atomic Birthplace" Plaque



Law School Library, reflecting pond, and "Construction in Space in the Third and Fourth Dimensions," by Antoine Pevsner.

POINTS OF INTEREST

"Atomic Birthplace" Plaque (B-4), Stagg Field west fence, marks the spot where Enrico Fermi and 41 other scientists achieved man's first self-sustaining atomic chain reaction at 3:25 P.M., December 2, 1942.

Rockefeller Memorial Chapel (D-6), 1156 East 59th Street, symbolizing the spirit of religion on the Quadrangles, is noted for its true Gothic construction, vaulted ceiling, and 72-bell carillon. Religious services are held at 11:00 A.M. each Sunday the University is in session, with sermons by the Dean of the Chapel or outstanding guest clergymen. Free tours of Chapel, carillon, and 17-story tower are conducted after services. Phone MI 3-0800, ext. 3381.

Bond Chapel (D-4), southwest of Swift Hall, is approached through an arch at 1050 East 59th Street. Open for prayer and meditation weekdays 9:00 A.M.–5:30 P.M.; closed Saturday; open Sunday 8:00 A.M.–12:00 M. Regularly scheduled Episcopal services 5:05 P.M. Wednesdays, 9:30 A.M. Sundays.

Oriental Institute (D-6), 1155 East 58th Street, houses an extensive collection of Near Eastern art and archeological findings. (See reverse side of map.)

University of Chicago Press (C-3), 5750 Ellis Avenue, the oldest university press in continuous existence in the country, publishes 30 academic journals and more than 100 books annually. The Press welcomes visitors. Stop at the Press Information Desk.

International House (D-10), 1414 East 59th Street, is the campus home for 510 foreign and American students. The cafeteria is open daily for breakfast, for lunch, and for dinner (except Saturday). Phone: FA 4-8200.

Midway Studios (F-2), 6016 Ingleside Avenue, former workshop of sculptor Lorado Taft, have now been turned over to the Department of Art.

Robie House (C-7), 5757 Woodlawn Avenue, is the internationally known "prairie house" designed by Frank Lloyd Wright which revolutionized the architecture of American homes.

Registered National Historic Landmarks: "Atomic Birthplace," Midway Studios and Robie House.

NEIGHBORS

The American Bar Center (F-6), 1155 East 60th Street, one block east of the Law School, provides offices for the national headquarters of the American Bar Association, the American Bar Foundation (one of the nation's largest legal research and educational institutions) and eight other affiliated national legal organizations. Phone: HY 3-0533.

Public Administration Center (F-9), 1313 East 60th Street, houses the national offices of 22 organizations in the field of public administration. Phone: FA 4-3400.

Center for Research Libraries (C-1), 5721 Cottage Grove Avenue, is a cooperative library, supported by 20 midwest universities and the John Crerar Library, Phone: MU 4-4545.

Adlai E. Stevenson Institute of International Affairs (C-7), 5757 Woodlawn Avenue, is a memorial center for the study of problems of international concern. Phone: 467-6162.

GENERAL INFORMATION

University Address and Telephone: The University of Chicago, 5801 South Ellis Avenue, Chicago, Illinois 60637. Phone: MI 3-0800.

University Hospitals and Clinics: 950 East 59th Street, Chicago, Illinois 60637. Phone: MU 4-6100.

Parking permitted on both sides of the tree-lined Midway Plaisance (E-1-9) and other city streets, and pay parking all day, University parking lot (C-2), 58th Street between Ellis and Drexel Avenues.

Transportation Hints: To-From Downtown: Via Illinois Central Railroad (D-10), 57th or 59th Street stations; via Chicago Transit Authority (CTA) Bus Lines near the University: Bus No. 4, Cottage Grove Avenue (A-F-1), when downtown board on Wabash Avenue from Randolph Street on south; Bus No. 55, East 55th Street (A-1-7); Bus No. 59, East 61st Street (F-1-10); Bus No. 28, Lake Park and Stony Island Avenue, one block east of Illinois Central Railroad at 57th Street.

Meals: International House (D-10), 1414 East 59th Street (See "Points of Interest.") Center for Continuing Education: (F-8), cafeteria and dining room.

Bookstore (D-3), 5802 Ellis Avenue. Hours: Weekdays 8:00 A.M.–5:00 P.M.; Saturday 8:00–12:00 M. It houses a quick-lunch counter, books, magazines, newspapers, student supplies, and various gift departments.

Information Desk and Lost and Found, lobby, Administration Building (C-D-4). Student addresses available. Phone: MI 3-0800, ext. 2381.

First Aid, Emergency Room, north side of Goldblatt Pavilion (D-2), entrance south on Drexel from 58th Street. Phone: MU 4-6100, ext. 5412.

Campus Police, 5750 Ellis Avenue, rear of Press Building (C-3). Phone: MI 3-0800, ext. 3061.

Campus Tours, every Saturday 10:00 A.M., starting from Ida Noyes Hall (D-7), 1212 East 59th Street. Reservations for special groups may be made for other times. Phone: MI 3-0800, ext. 4425, 4429.

Admissions Office, Room 203, Administration Building (C-D-4), 5801 Ellis Avenue. Phone: MI 3-0800, ext. 3220.

Quadrangle Club (C-6), 1155 East 57th Street, for faculty. Phone: HY 3-8601.

Center for Continuing Education (F-8), 1307 East 60th Street. Phone: BU 8-2500. (See reverse side of map.) (Also see "Meals.")

STUDENT LIFE

More than ninety student organizations function on the Quadrangles. **Ida Noyes Hall** (D-7), 1212 East 59th Street, houses the offices of the student newspaper, **The Chicago Maroon,** Student Government, and other groups. In **Mandel Hall** (C-5), 1135 East 57th Street, students act in plays, listen to distinguished lecturers, and hear concerts and poetry readings. Year-round facilities for an extensive athletic program—both intercollegiate and intramural—are provided for men in **Bartlett Gymnasium** (B-5), 5640 University Avenue; the **Field House** (A-5), 5550 University Avenue; and for women in **Ida Noyes Hall.**

Dinner - December 1

	Table
Dr. & Mrs. Harold M. Agnew	15
Mr. & Mrs. A. Adrian Albert	1
Mrs. S. K. Allison	sp.
Mr. & Mrs. Herbert L. Anderson	sp.
Robert L. Ashenhurst	1
Robert Avery	21
Dale F. Babcock	14
Delbert L. Ball	24
N. E. Ballou	25
H. M. Barton, Jr.	20
George M. Baumann	20
G. W. Beadle	sp.
Frances J. Beck	26
Wallace B. Behnke, Jr.	6
Prof. Gilberto Bernardini	3
Seymour Bernstein	21
William McCormick Blair	3
G. E. Boyd	21
Edward L. Brady	25
Egon Bretscher	27
Thomas Brill	18
John E. Brolley	20
R. R. Buntaine	13
Dr. Warren H. Burgus	20
Ralph W. Burhoe	26
Melvin Calvin	sp.
George W. Campbell, Jr.	25
Rose A. Carney & Guest	7
Arthur Alan Compton	sp.
Mrs. Arthur Holly Compton	sp.
James S. Connor	25
Charles D. Coryell	11
Joseph Ceithaml	26
S. Chandrasekhar	3
George A. Cowan	14
E. Creutz	7
A. V. Crewe	4
Nick S. Dallas	24
Morton M. David	24
Mr. & Mrs. Richard L. Doan	17
James J. Doheny	26
J. E. Draley	23
Mr. & Mrs. Robert B. Duffield	7
Kenneth A. Dunbar	8
Dr. & Mrs. John R. Dunning	8
Octave J. DuTemple	6
Dr. Sigvard Eklund	4
Milton W. Ellen	6
Spofford G. English	4
John A. Erlewine	22
Irene E. Fagerstrom	22

	Table
Mr. & Mrs. Ugo Fano	16
J. R. Farmakes	18
B. T. Feld	15
Laura Fermi	sp.
Prof. & Mrs. H. Fernandez-Moran	3
H. R. Fischer	27
Frank G. Foote	28
Mr. & Mrs. Stewart Fox	13
Hymer L. Friedell	27
Arnold R. Fritsch	5
Herman H. Fussler	17
Joseph J. Gallagher	22
Tom C. Gary	22
Donald R. Getz	25
Russell L. Geuther	23
Mr. & Mrs. Julian R. Goldsmith	3
Dr. & Mrs. Sheffield Gurdon	27
John Graham	25
Crawford H. Greenewalt	15
J. Gueron	20
David H. Gurinsky	15
Mr. & Mrs. Mikkel R. Hansen	6
W. B. Harrell	2
Robert J. Hasterlik	11
John F. Hegarty	25
Richard G. Hewlett	6
Norman Hilberry	1
Roger Hildebrand	1
Dr. David L. Hill	19
Otto Hillig	18
Mr. & Mrs. E. P. Hincks	9
F. deHoffmann	2
Gerald Holton	17
Dr. & Mrs. John P. Howe	15
Dwight J. Ingle	15
David Inglis	12
Mr. & Mrs. L. O. Jacobson	12
Arthur H. Jaffey	9
R. F. Johnson	18
Mr. & Mrs. Warren C. Johnson	1
Murray Joslin	20
Dr. & Mrs. W. R. Kanne	14
Joseph J. Katz	12
George M. Kavanagh	12
Dr. & Mrs. L. D. P. King	9
Mr. & Mrs. August C. Knuth	18
Mr. & Mrs. L. J. Koch	21
W. Kolos	21
George A. Kolstad	19
Emil J. Konopinski	7
Dr. & Mrs. Philip G. Koontz	20

	Table
Lester Kornblith, Jr.	20
L. Kowarski	17
Ferd Kramer	10
Sol Krasner	18
H. R. Kratz	4
Theodore F. Krohne	14
Herbert E. Kubitschek	14
A. M. Labowitz	14
Tom B. Lanahan III	13
Stanley B. Langrand	12
Alexander Langsdorf, Jr.	19
C. E. Larson	23
Stephen Lawroski	4
Richard S. Lewis	5
W. B. Lewis	19
Mr. & Mrs. Willard Libby	10
Harold V. Lichtenberger	17
Mr. & Mrs. Francis V. Lloyd, Jr.	5
Theodore T. Magel	8
J. L. Mandereau	2
J. H. Manley	1
Dr. John Marshall	19
Robert I. Martens	23
Max S. Matheson	15
Mr. & Mrs. Anthony J. Matz	23
John H. McKinley	25
N. Metropolis	16
George Miller	13
Mr. & Mrs. George D. Monk	13
Norman H. Nachtrieb	4
D. Nagle	7
V. A. Nedzel	13
Theodore J. Neubert	22
Robert G. Nobles	27
T. B. Novey	28
Meyer Novick	23
Mr. & Mrs. W. E. Nyer	22
His Exc. Egidio Ortona	sp.
A. M. Ostoya	24
Wilcox P. Overbeck	17
J. Howard Parsons	23
G. S. Pawlicki	23
Luther C. Peery	24
Arthur V. Peterson	22
Mr. & Mrs. M. D. Peterson	24
Mr. & Mrs. Thomas Petry	27
Mr. & Mrs. Robert L. Platzman	19
Dr. Philip Powers	6
Norman Ramsey	9
L. Reiffel	5
Clement J. Rodden	25
Walton A. Rodgen	17
Lt. Col. Jack Rosen	26
Robert Rosenthal	5
Julius H. Rubin	12
Mr. & Mrs. D. P. Rudolph	18
Edwin R. Russell	24

	Table
Consul Gen. & Mrs. Augusto Russo	sp.
Mr. & Mrs. Elmer Rylander	22
Alexander Sachs	9
Robert G. Sachs	6
Mr. & Mrs. Thomas J. Sandlke	26
Leon Sayvetz	22
A. E. Schubert	1
Dr. & Mrs. Glenn T. Seaborg	9
Prof. & Mrs. E. Segrè	sp.
Leo Seren	17
Dr. William Shockley	16
J. A. Simpson	11
Mrs. Solomon B. Smith	3
Dr. & Mrs. Henry Dewolf Smyth	10
Mr. & Mrs. Arthur H. Snell	6
Dr. T. M. Snyder	5
Dr. F. H. Spedding	4
Neal Stanford	26
Dr. & Mrs. Andrew Stehney	5
Mr. & Mrs. Sydney Stein, Jr.	10
Rose E. Sternheimer, M.D.	17
Edwin E. Stokely	5
Mrs. Margaret Strozier	10
William J. Sturm	5
Nathan Sugarman	3
Mrs. Leo Szilard	11
Mr. & Mrs. Julius Tabin	11
Gerald F. Tape	1
V. L. Telegdi	11
Dr. & Mrs. Marvin Tetenbaum	14
Ernest W. Thiele	21
Mr. & Mrs. R. W. Thompson	3
Anthony M. Trozzolo	26
James L. Tuck	16
Mr. & Mrs. Anthony Turkevich	16
Mr. & Mrs. Utley	10
James W. Vice	23
Stephen J. Walden	21
A. Wattenberg	19
Donald S. Webster	12
Alvin M. Weinberg	7
Charles Weiner	
Nella Weiner	12
Mr. & Mrs. G. Wentzel	4
Dr. Sol Wexler	8
John A. Wheeler	2
Dr. & Mrs. Harley A. Wilhelm	16
Dr. & Mrs. Marvin H. Wilkening	13
J. Ernest Wilkins, Jr.	12
Mr. & Mrs. John E. Willard	8
Mr. & Mrs. Volney C. Wilson	2
Mr. & Mrs. A. Wohlstetter	2
E. O. Wollan	16
Nancy F. Wood	24
S. C. Wright & Guest	11
Mr. & Mrs. W. H. Zachariasen	7
Dr. & Mrs. Walter H. Zinn	sp.

Spring 1934 (Easter) [illegible] → Fl
1934 - 35 Neutron Work

Lord Rutherford –

Fall 1934 con'tol neutron – anomalies

Oct 22, 1934 – slow neutrons (disc.)

Winter 1935/36 Polit. sit. alert, Work in Rome slows – Conc. on slow neutrons

Defer. 1936 – 37

Nobel Prize awarded Arr Jan 2, 1939

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THE DOWNTOWN CENTER BRANCH
64 E. LAKE STREET

THE DOWNTOWN PROGRAM BRANCH
190 E. DELAWARE PLACE

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UNIVERSITY OF CHICAGO CAMPUS

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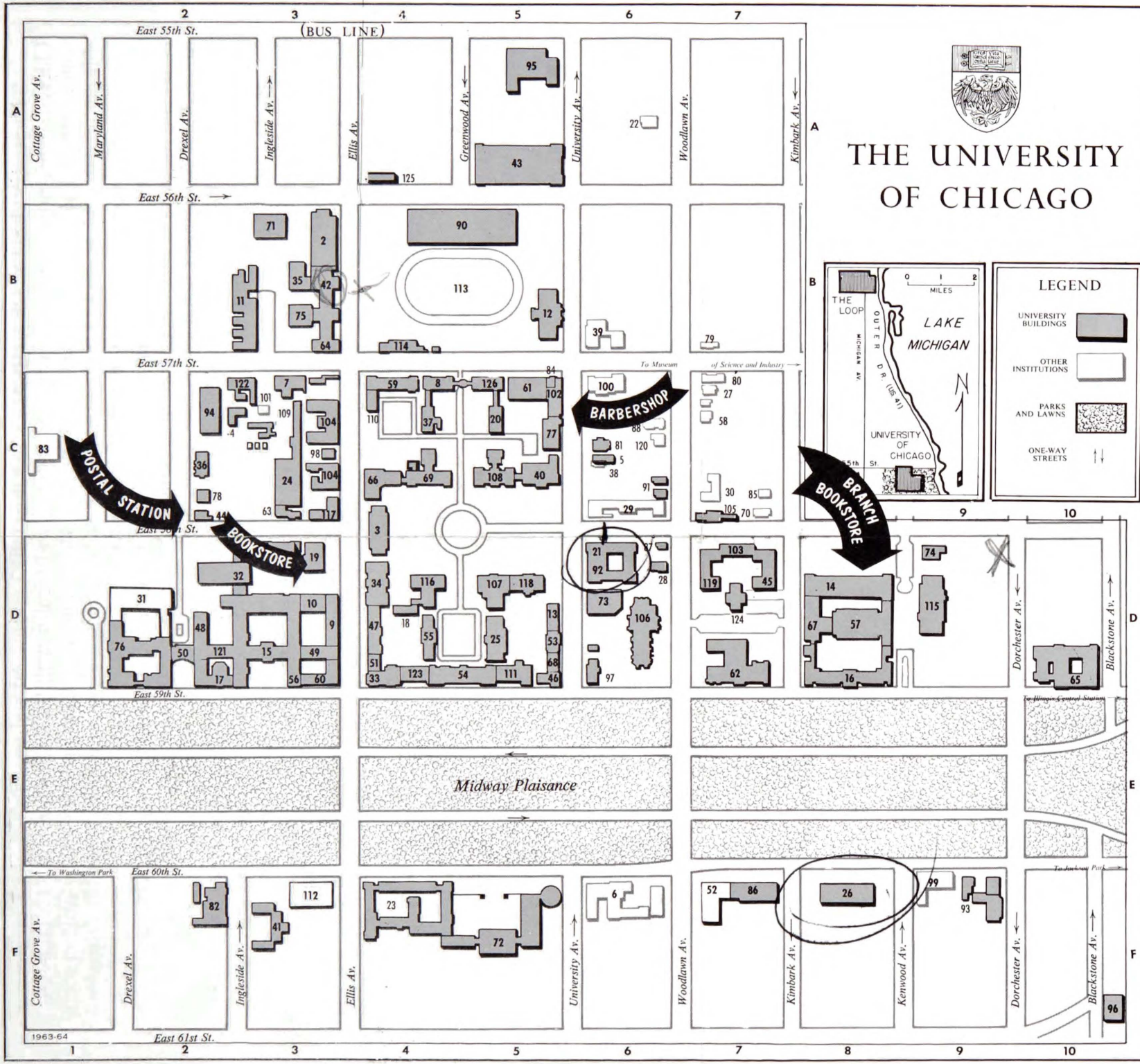
UNIVERSITY OF CHICAGO BOOKSTORES



THE UNIVERSITY OF CHICAGO

1. ABBOTT (*D-3*)
2. ACCELERATOR BUILDING (*B-3*)
3. ADMINISTRATION BUILDING (*C and D-4*)
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5. ALUMNI HOUSE (*C-6*)
6. AMERICAN BAR CENTER (*F-6*)
7. AMERICAN MEAT INSTITUTE (*C-3*)
8. ANATOMY BUILDING (*C-4*)
9. ARGONNE HOSPITAL (*D-3*)
10. ARMOUR CLINICAL RESEARCH BUILDING (*D-3*)
11. BARNES (*B-2 and 3*)
12. BARTLETT GYM (*B-5*)
13. BEECHER HOUSE (*D-5*)
14. BELFIELD (*D-5*)
15. BILLINGS HOSPITAL (*D-3*)
16. BLAINE (*D-8*)
17. BOBS ROBERTS HOSPITAL (*D-2*)
18. BOND CHAPEL (*D-4*)
19. BOOKSTORE (*D-3*)
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21. BREASTED (*D-6*)
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33. CLASSICS (*D-4*)
34. COBB (*D-4*)
35. COMPUTER BUILDING (*B-3*)
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37. CULVER (*C-4*)
38. DE SALES HOUSE (*C-6*)
39. DISCIPLES HOUSE (*B-6*)
40. ECKHART (*C-5*)
41. FACULTY APTS. (*F-3*)
42. FERMI INSTITUTE (*B-3*)
43. FIELD HOUSE (*A-5*)
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46. FOSTER HOUSE (*D-5*)
47. GATES-BLAKE (*D-4*)
48. GILMAN SMITH HOSPITAL (*D-2*)
49. GOLDBLATT HOSPITAL (*D-3*)
50. GOLDBLATT PAVILION (OUT PATIENT) (*D-2*)
51. GOODSPEED (*D-4*)
52. GRADUATE SCHOOL OF BUSINESS (PROPOSED) (*F-7*)
53. GREEN HOUSE (*D-5*)
54. HARPER LIBRARY (*D-4 and 5*)
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56. HICKS HOSPITAL (*D-3*)
57. HIGH SCHOOL (*D-8*)
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59. HITCHCOCK HOUSE (*C-4*)
60. HOME FOR DESTITUTE CRIPPLED CHILDREN (*D-3*)
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62. IDA NOYES (*D-7*)
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64. INSTITUTE FOR THE STUDY OF METALS (*B-3*)
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80. MEADVILLE THEOL. SEM. (*C-7*)
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88. NATIONAL OPINION RESEARCH CENTER (*C-7*)

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92. ORIENTAL INSTITUTE (*D-6*)
93. ORTHOGENIC SCHOOL (*F-9*)
94. PHEMISTER HALL (*C-2*)
95. PIERCE HALL (*A-5*)
96. POWER PLANT (*F-10*)
97. PRESIDENT'S HOUSE (*D-6*)
98. PSYCHOLOGY (*C-3*)
99. PUBLIC ADMINISTRATION CENTER (*F-9*)
100. QUADRANGLE CLUB (*C-6*)
101. RADIATION LAB. (*C-3*)
102. REYNOLDS CLUB (*C-5*)
103. RICKERT HOUSE (*D-7*)
104. RICKETTS (*C-3*)
105. ROBIE HOUSE (*C-7*)
106. ROCKEFELLER CHAPEL (*D-6*)
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108. RYERSON (*C-5*)
109. SERVICE BUILDING (*C-3*)
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111. SOCIAL SCIENCE (*D-5*)
112. SOCIAL SERVICE (PROPOSED) (*F-3*)
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114. STAGG FIELD LAB. (*B-4*)
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116. SWIFT (*D-4*)
117. UNIVERSITY PRESS (*C-3*)
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121. WEST WING (*D-2*)
122. WHITMAN (*C-2 and 3*)
123. WIEBOLDT (*D-4*)
124. WOODWARD COMMONS (*D-7*)
125. YOUNG BLDG. (*A-4*)
126. ZOÖLOGY (*C-5*)

25TH ANNIVERSARY OBSERVANCE
OF FIRST NUCLEAR CHAIN REACTION
December 1 and 2, 1967
The University of Chicago

PRELIMINARY PROGRAM

FRIDAY, December 1

8:45 a.m. — REGISTRATION.
Breasted Hall, 1155 East 58th Street

9:15 a.m. — Opening Remarks, GEORGE W. BEADLE

9:30 a.m. — RETROSPECTIVE SESSION
Breasted Hall, 1155 East 58th Street

Chairman: H. DeW. SMYTH
Speakers:
HERBERT ANDERSON, 9:30 a.m.
WALTER ZINN, 10:00 a.m.
EUGENE WIGNER, 11:00 a.m.
CRAWFORD GREENEWALT, 11:40 a.m. (Hanford Dupont)

10:40 a.m.
Coffee Break

12:45 p.m. — LUNCHEON
R
The Quadrangle Club, 1157 East 57th Street

2:00 p.m. — APPLICATIONS OF ATOMIC ENERGY SESSION
Breasted Hall, 1155 East 58th Street

Chairman: ALBERT V. CREWE
Speakers:
WILLARD F. LIBBY, Atomic Chemistry, 2:20 p.m.
MELVIN CALVIN, New Keys to Life Processes, 3 p.
ALVIN WEINBERG, The Age of Nuclear Power, 3:40

6:30 p.m. — DINNER
R
Center for Continuing Education, 1307 E. 60th Stre

Speaker: EMILIO SEGRE

SATURDAY, December 2

9:30 a.m. — PROSPECTIVE SESSION
Breasted Hall, 1155 East 58th Street

Chairman: GLENN SEABORG
Speakers:
W. B. LEWIS, Prospect for Heavy Water Reactors, 9:30 a.m.
FRANCIS PERRIN, Atomic Energy for Power Production in France, 10:00 a.m.
A. A. SIGVARD EKLUND, The International Atom, 11:40 a.m.

10:40 a.m.
Coffee Break

12:45 p.m. — LUNCHEON
R
The Quadrangle Club, 1157 East 57th Street
Speaker: ALBERT WOHLSTETTER, on A Perspective on the Implications of Atomic Energy.

SATURDAY AFTERNOON, December 2

3:00 p.m.	Unveiling Ceremonies for NUCLEAR ENERGY, a sculpture by Henry Moore, commissioned specially in observance of the 25th Anniversary of the first nuclear chain reaction. Ceremony at 5635 South Ellis Avenue
4:00 p.m.	Photo exhibition of the evolution of the sculpture, NUCLEAR ENERGY. High Energy Physics Building, 933 East 56th Street.
5:30 p.m.	Reception at the Reynolds Club, 5706 South University Avenue (adjacent to Hutchinson Commons).
6:30 p.m.	Dinner in Hutchinson Commons, 5706 South University Avenue.
8:30 p.m.	Motion Picture Documentary on the Chicago Pile, Mandel Hall, adjacent to Hutchinson Commons, 5706 South University Avenue.

* * * * * *

R

R - U. of C.
5801 S. Ellis Ave
R. 300
60637
11-27-67

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

DEC 8 1967

Mrs. Leo S. Szilard
2380 Torrey Pines Road
LaJolla, California 92038

Dear Mrs. Szilard:

It is a pleasure to send you herewith a copy of a new educational booklet, "The First Reactor", which we have issued for the 25th anniversary of the first controlled nuclear chain reaction. It incorporates a text you doubtless have seen before, but we have given it a new format and included new illustrations.

We plan to keep supplies of this booklet permanently available for distribution to students and others, as part of the Understanding the Atom series. It should therefore inform and inspire the public for years to come.

Should you wish additional copies at any time, please write me.

Sincerely,

Edward J. Brunenkant, Director
Division of Technical Information

Enclosure
"The First Reactor" (1)

AEC

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

No. K-260
Tel. 973-3335 or
973-3446

November, 1967

CP-1 IN THE RACE FOR THE ATOMIC BOMB

by
Dr. Richard G. Hewlett
Chief Historian
U. S. Atomic Energy Commission

Enrico Fermi's famous experiment in Chicago on December 2, 1942, marked the end of the first lap in the desperate race against the Germans for the atomic bomb.

That race had begun early in January 1939 when the world renowned physicist, Niels Bohr, arrived in New York with some electrifying news. Two German scientists, Otto Hahn and Fritz Strassmann, had been bombarding the heavy element uranium with neutrons. They had discovered that the neutrons split the uranium atoms in two, a reaction that theoretically would release tremendous amounts of energy. Scientists the world over rushed to their laboratories to verify not only the German experiment but also the possibility that each fission might release several free neutrons, which in turn would cause additional fissions. The results suggested the possibility of starting a self-sustaining chain reaction which would produce energy for a variety of uses or perhaps a weapon of incredible power.

In the United States during 1939 the discovery had little impact outside university laboratories. American physicists explored the fission process in hundreds of experiments, but only a few men--for the most part those who had fled the tyranny of Nazi Germany--saw immediate implications for the new force on the world scene. A letter from Albert Einstein to President Roosevelt brought no action until early 1940, and even then Government support was hardly adequate for a few experiments at Columbia University.

Arguments for a cautious approach seemed obvious. A demonstration of the chain reaction would require more uranium metal than then existed in the entire western world. It seemed unlikely that the reaction would be useful as a power source without many years of development, and in 1940 the United States still seemed too far from war in Europe to justify expenditures for developing an atomic weapon. An added deterrent was the discovery by John R. Dunning and Alfred O. C. Nier and their associates that most of the fissions occurred in uranium 235, a lighter isotope of the element which constitutes less than 1 per cent of the material as found in nature. Isotope separation was a difficult process not yet employed on more than a laboratory scale. Even if it could be used to produce uranium 235, it would be fantastically expensive.

(more)

A small committee of Government officials working under Lyman J. Briggs, director of the National Bureau of Standards, concluded in the spring of 1940 that the prudent course was to finance some research on isotope separation on a very small scale and some preliminary work which Fermi and Leo Szilard proposed on the chain reaction. Their idea was to assemble blocks of graphite interspersed with lumps of uranium to form a "pile." The graphite would slow down or "moderate" the neutrons coming from the fission reaction and thereby increase the probability of their causing additional fissions in sustaining the chain reaction. If the pile contained a large amount of natural uranium metal, there would be enough uranium 235 for the fission reaction. A few experiments on isotope separation and Fermi's work with neutron reactions in graphite constituted the whole of the Government's effort in 1940.

New forces, however, were already at work before the end of 1940. As American involvement in the war became more likely, President Roosevelt had turned to Vannevar Bush and James B. Conant to marshal the nation's scientists for defense. Already interested in the uranium project, Bush revitalized the Briggs committee before the end of the year, and early in 1941 Ernest O. Lawrence, director of the Radiation Laboratory at the University of California, added his energy and enthusiasm to the efforts of those who favored increased Government support. Research by a group under Glenn T. Seaborg at Berkeley had led to the discovery of a new man-made element later named "plutonium." Like uranium 235, plutonium would fission and apparently could be made in the pile from the plentiful uranium 238 isotope. If Fermi's research proved successful, the pile might be a much better source of fissionable material than an isotope separation plant.

The one remaining obstacle to a full-scale effort on nuclear fission was the lack of evidence that it would have any practical application in the war effort. Without such an assurance, Conant and Bush did not dare risk investing already scarce resources of scientific talent and materials in nuclear research. Two studies of research progress by a special committee of the National Academy of Sciences in 1941 failed to reveal hopeful prospects. Then on July 10, 1941, Bush learned that the British were convinced an atomic bomb was feasible. They believed they could build an isotope separation plant and design an atomic weapon of reasonable size. This was the evidence Bush and Conant had been seeking. A few days before the Japanese attack on Pearl Harbor they recommended to President Roosevelt an all-out research effort on methods of producing fissionable material and the bomb.

The United States had taken more than two years to join the war against Germany, and it seemed possible the nation was that far behind the Germans in developing the atomic bomb. Time was of the essence. No one understood that better than Arthur H. Compton, the distinguished physicist whom Bush had asked to direct the plutonium project. With the odds favoring the uranium 235 approach, Compton knew he faced an awesome task. He had no laboratories, no scientists, no equipment, and no materials, but he went to work. Within a few weeks he had convinced many of the nation's leading scientists, including Fermi, to join him in a new laboratory at the University of Chicago. With help from the Office of Scientific Research and Development, he and a small group of associates began a feverish quest for the materials necessary for the chain reaction:

(more)

large quantities of incredibly pure graphite and amounts of uranium metal that staggered the imagination. He borrowed equipment and installed it in classrooms at Chicago.

While Compton struggled to create a laboratory for the chain reaction at Chicago, Fermi continued to study neutron multiplication in the small assembly of low-grade graphite and uranium oxide at Columbia. Fermi's results were encouraging but could not be conclusive. Despite heroic work to produce the necessary materials, construction of the pile under the west stands of the Chicago stadium ground to a halt in the fall of 1942 as the available stocks of graphite and uranium metal were exhausted.

The day of decision was fast approaching. Convinced that the chances for an atomic bomb were good, Bush had brought in the Army Engineers to transform laboratory experiments into operating plants. Under the hard-driving General Leslie R. Groves, the pace of the Manhattan Project was quickening every day. Groves had appointed a special committee of outstanding engineers to examine progress on each of the four methods then being considered for producing fissionable material. Unless Fermi and his team could complete the Chicago pile (later called "CP-1") before the reviewing committee arrived in late November, 1942, Compton's dream of producing plutonium for the bomb might be shattered.

In a final effort to speed completion of the pile, Fermi decided to use substandard graphite and uranium oxide for the outer regions of the assembly. Teams of scientists working around the clock slaved over the bars of slippery graphite. Even these extraordinary efforts seemed doomed to failure. When the reviewing committee arrived in Chicago on Thanksgiving Day, the pile was not yet complete. One last hope lay in the fact that the committee would again be in Chicago after visiting Lawrence's laboratory in Berkeley. Compton ordered Fermi to proceed at top speed. When the committee returned on the morning of December 2, 1942, Fermi was ready. The successful demonstration that day assured continuation of the plutonium project and kept alive the hopes that the United States would win the race for the bomb. These hopes were realized less than three years later, when the first assembly of fissionable material (plutonium) was detonated at Alamogordo, New Mexico.

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THE UNIVERSITY OF CHICAGO
DEPARTMENT OF MEDICINE
950 EAST 59TH STREET · CHICAGO · ILLINOIS 60637
MUSEUM 4-6100

HANS H. HECHT, M.D.
Chairman

December 26, 1967

Dr. Eugene Braunwald
National Heart Institute
National Institutes of Health
Building 10, Room 7B15
Bethesda, Maryland
20014

Dear Gene:

On the occasion of the 25th anniversary of the sustained nuclear reaction at the University of Chicago under the leadership of Enrico Fermi and Leo Szilard we had an impressive ceremony. It culminated in the unveiling of a sculpture by Henry Moore. I had the occasion to meet Mrs. Szilard who had been an honored guest on this occasion. Mrs. Szilard is a physician interested in community health problems and is now working at La Jolla at 2380 Torrey Pines Road. Since her husband's death, she practices under her maiden name, Dr. Gertrude Weiss. She is, of course, very much interested in the new developments at La Jolla and at U.C.S.D. She would like very much to have an opportunity to talk to you about your future plans and to discover how she might possibly be of some help to you.

I simply pass this observation on since I know that willing hands are hard to come by and one needs all the strength one can get.

With best wishes.

Sincerely yours,

Hans H. Hecht, M.D.
Professor and Chairman

HHH/akc

CC: Dr Gertrude Weiss

H.H. Hecht, M.D.
THE UNIVERSITY OF CHICAGO
950 EAST 59TH STREET
CHICAGO • ILLINOIS 60637
DEPARTMENT OF MEDICINE

VIA AIR MAIL

Dr. Gertrude Weiss
~~2380 Torrey Pines Road~~
La Jolla, California

c/o Dr. Rachel
305 Brookfield
Ithaca, NY
14850


PM
DEC
1967
LA JOLLA
DEC
1967
92037

FÉDÉRATION POUR LE RESPECT DE L'HOMME ET DE L'HUMANITÉ

F. R. H.

C.T.N.

CENTRE D'ÉTUDE DES CONSÉQUENCES GÉNÉRALES DES GRANDES TECHNIQUES NOUVELLES

BULLETIN BIMESTRIEL
SIXIÈME ANNÉE
NOVEMBRE 1967
N° 44

Siège Social : 14 Boulevard Poissonnière - Paris 9e - 770-92-25
Association déclarée conformément à la loi du 1er Juillet 1901

Extrait des statuts du

CENTRE D'ÉTUDE DES CONSÉQUENCES GÉNÉRALES DES GRANDES TECHNIQUES NOUVELLES (C. T. N.)

Objet de l'Association. Article 2.

L'Association a pour objet :

— l'étude des conséquences générales des grandes techniques nouvelles en fonction de l'homme et de l'humanité dans sa diversité et en vue de son unité finale ;

— la diffusion d'informations sélectionnées pour leur valeur significative et de réflexion relatives à cette étude.

Cet objet doit être précisé ainsi :

a) Par opposition à nouveauté ou développement techniques, l'Association entend par grandes techniques nouvelles des disciplines telles que sont actuellement : l'astronautique ; la biologie, la psychologie ; l'énergie atomique, l'énergie solaire ; l'électronique, l'automation, la cybernétique ; le calcul, la recherche opérationnelle, etc.

Elles marquent, en effet, le passage de la première ère scientifique et industrielle à une ère nouvelle dans laquelle entre maintenant l'humanité et, par leur nature même, vont influencer profondément ou transformer les rythmes et les modes de vie et certains modes de pensée.

b) Au delà de leurs implications scientifiques ou techniques, l'Association étudie les conséquences générales de ces grandes techniques nouvelles en fonction de leurs incidences économiques, sociologiques, stratégiques, culturelles, esthétiques, philosophiques, spirituelles tant sur la vie personnelle que sur celle des groupes ou de la société.

c) Une telle entreprise, conduite en équipe, vise à :

— participer concrètement, et en toute indépendance, à l'effort de réflexion générale qu'exige l'évolution de l'homme et de l'humanité à leur entrée dans l'ère des grandes techniques nouvelles ;

— promouvoir l'entraînement de groupes de non-spécialistes — et de spécialistes aptes à dépasser les frontières de leur spécialité — à une méthode de synthèse appliquée aux dimensions véritables des problèmes essentiels posés désormais par l'avenir de l'homme ;

— contribuer, par diffusion d'informations ou de suggestions, à élargir les prises de conscience indispensables, auprès d'une sélection de plus en plus étendue d'hommes assumant des responsabilités dans les disciplines les plus diverses et dans tous les milieux ;

— susciter ainsi des efforts de réflexion et des réactions militantes permettant des interprétations susceptibles de faire percevoir et mettre en œuvre progressivement les modifications d'attitude et les réflexes d'adaptation nécessaires.

Les documents bimestriels élaborés par le C.T.N. bénéficient de l'effort consacré à ce même problème général de 1955 *à* 1962 *par la Société Internationale des Conseillers de Synthèse, ils font suite aux notes de lecture C S P T N nº* 1 *à* 39.

AVANT-PROPOS

Ce bulletin n° 44 paraîtra quelques jours seulement avant l'Assemblée Générale commune du C.T.N., du C.R.M. et de la F.R.H. Que cette Assemblée se tienne, en 1967, dans une salle de l'Unesco, symbolise le développement qualitatif de nos relations avec les grandes institutions internationales. Nos adhérents auront d'ailleurs senti, depuis un an, à quel point la réflexion poursuivie sur les conséquences générales des grandes techniques nouvelles conduit à s'interroger sur leur influence croissante dans les rapports entre Etats, sur l'évolution générale de ces rapports et sur la signification de cette évolution générale à l'égard des comportements individuels. Cela tient de plus en plus au changement dimensionnel qu'entraîne la mise en œuvre de ces techniques. Ce changement n'a pas seulement pour effet de modifier les données stratégiques ou d'ajouter aux problèmes classiques de la diplomatie des sujets nouveaux comme le « brain drain », le droit de l'espace, ou l'organisation de réseaux de mondovision. Il impose essentiellement un cadre de réflexion et d'action qui dépasse celui des Etats et des Nations. Pour certains, il conduit ainsi à un accroissement du travail et de la dimension des organismes nationaux chargés des « affaires étrangères ». Pour d'autres, il fait accéder les Etats et les Nations à un niveau supérieur d'organisation où leur maintien et leur vitalité dépendent de leur coopération avec des organismes qualifiés pour traiter à l'échelle des continents et du monde les sujets effectivement posés à cette échelle.

Ainsi, lorsque nous lisons, dans ce bulletin, que la convention sur l'assistance des cosmonautes en danger est soumise aux lentes procédures « normales » d'examen par les Nations Unies, ce qui implique qu'elles le seront à celles, plus lentes encore, de la ratification par les pays membres, nous ne pouvons manquer de réfléchir à la contradiction entre ces lenteurs et l'objet même de la convention. Car ces cosmonautes en danger à qui il faudrait prêter assistance, ne passeraient que quelques minutes dans le « ciel de chaque Etat » — si vaste soit-il — alors que les opérations de sauvetage devraient évidemment être prises en charge par un seul organisme qualifié.

De même, qui peut répondre aux suggestions du Professeur Teller envisageant des explosions atomiques sur la lune ou à ces ingénieurs de la N.A.S.A. proposant pour des raisons d'économie et de commodité de renoncer aux contraintes de stérilisation des véhicules spatiaux ? Un Etat ou un organisme supranational ? Ne sent-on pas d'ailleurs, au ton employé par le Président Johnson à propos des accords destinés à éviter la compétition pour l'exploitation des territoires sous-marins, que de semblables questions se posent sur notre planète et pas seulement lorsqu'on s'en évade ?

De tels problèmes se posent aussi au niveau des personnes. Il paraît en effet souhaitable — au nom des libertés individuelles — que chaque détenteur d'un poste de radio ou de télévision puisse recevoir directement les messages et les programmes que, bientôt, les satellites de communication rendront effectivement disponibles. Mais cela ne sera possible que si des accords mondiaux réglementent les définitions des appareils et les attributions de longueurs d'onde. L'équilibre entre les libertés et les contraintes se déplace chaque fois qu'il concerne un autre niveau d'efficacité. Il impose aussi la mise en place de l'autorité qualifiée pour l'établir et le maintenir.

Dans un autre ordre d'idées, il semble utile de réfléchir à l'utilisation des techniques avancées par des organismes ou des entreprises dont le champ d'activité initial était fort éloigné de telles préoccupations. C'est ainsi que l'intérêt porté à l'océanographie par des firmes engagées par ailleurs dans l'industrie spatiale ou la prise en charge par le centre atomique d'Harwell des problèmes de pollution atmosphérique dans le Royaume Uni sont révélateurs de la valeur — en soi — de l'effort technologique. Il crée des équipements et des comportements irremplaçables.

Nous n'insisterons ici que brièvement sur d'autres points de ce bulletin. Par exemple, la création, en Grande Bretagne, de cours pour les professeurs désireux de participer à la télévision éducative ou les réflexions de R. Colborn, rédacteur en chef de Science and Technology, *sur ce que devrait être le partage du temps d'enseignement des enfants, sont significatives du changement fondamental qui se prépare dans le domaine de la formation. De même, il faut beaucoup réfléchir au fait que le Japon se prépare à créer une cité scientifique à l'imitation de celles de la Sibérie. Un certain poids d'innovation semble faire pencher progressivement vers l'Orient le dynamisme, traditionnellement occidental, de l'organisation de la recherche. Enfin n'est-il pas surprenant que, parmi les inventions « à faire », celles qui concernent l'apparition de nouvelles espèces d'animaux et de plantes soient au nombre des innovations qui ne prêtent pas à controverse ? Les personnes interrogées pensent-elles vraiment que la « manipulation de l'homme » ne découlerait pas très vite de semblables progrès de la biologie ?*

Nous voulons signaler également à nos adhérents les deux textes rédigés par Georges et Jeannine Guéron à leur retour des Congrès de Ronneby, en Suède (Mouvement de Pugwash) et de Namur, en Belgique (Association internationale de Cybernétique), manifestations internationales où ils représentaient, sur invitation, nos Associations.

Il s'agit en effet de groupements auxquels le Bureau du C.T.N. attache depuis longtemps un intérêt particulier. Le Mouvement de Pugwash est la plus prestigieuse des organisations internationales de chercheurs, vouée à une réflexion (et à une action) à propos, non pas de problèmes scientifiques, mais des conséquences des découvertes scientifiques et techniques sur les grands problèmes mondiaux et notamment ceux des armements nucléaires, du désarmement et de la paix. Ce Mouvement a profondément senti, depuis quelques années, que les problèmes du Tiers Monde et du développement sont générateurs de tensions aussi fortes que les problèmes stratégiques et que leur solution dépend étroitement de son association à l'effort général de recherche et d'équipement. Une telle attitude correspond — partiellement mais fortement — à celle que les bureaux du C.T.N. et du C.R.M. plaident en équipe depuis longtemps. Et la notoriété des membres du Mouvement de Pugwash justifie l'effort de nos bureaux auprès de ce Mouvement.

Quant à l'Association internationale de Cybernétique, elle réunit, depuis dix ans, un autre type de chercheurs. Ils n'ont pas, en général accédé au même niveau de notoriété que ceux qui fréquentent les assemblées de Pugwash. Leurs préoccupations sont d'ailleurs moins directement liées aux conséquences générales des grandes techniques nouvelles. Mais leurs travaux ont un caractère interdisciplinaire très marqué et la liberté d'esprit et de discussion dont ils font preuve est rarement poussée à un tel degré dans des congrès spécialisés. La cybernétique, d'ailleurs, dans la mesure où elle se veut une science des relations et des systèmes complexes, est appelée à faire réfléchir sur l'aspect le plus impressionnant des changements des sociétés humaines, celui qui a trait à la prolifération des échanges et à la complexité des interventions qu'ils provoquent. Les membres du C.T.N. seront heureux d'apprendre que la conférence d'ouverture de ce Congrès a été prononcée par le Secrétaire Général de notre Association.

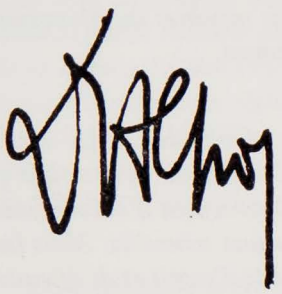
Nous espérons que les comptes rendus de ces Congrès — si schématiques qu'ils soient — souligneront certains progrès de notre réflexion générale.

Récemment deux membres de nos bureaux — Michèle Aumont et le Docteur Gros — ont eu la joie de travailler à Rome à l'occasion du Synode. Ils ont pu constater les réactions d'intérêt dont ils ont bénéficié lorsqu'ils ont abordé certains problèmes généraux en tenant le plus grand compte du travail réalisé par le C.T.N. et le C.R.M.

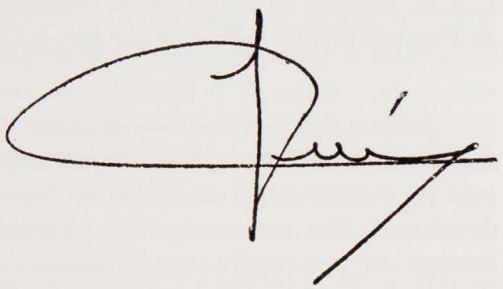
En terminant cet avant-propos, les membres des bureaux du C.T.N., du C.R.M. et de la F.R.H. tiennent à rendre hommage à leur ami le Professeur Jacques Parisot. Sa récente disparition les a profondément attristés. L'un d'entre nous — le Docteur Gros — avait collaboré avec lui depuis 1937. *Nous avions apprécié infiniment sa culture et sa loyauté, sa bonté et sa capacité d'engagement. Il nous avait constamment fait bénéficier de ses conseils et de sa totale solidarité. Il portait un intérêt enthousiaste à notre réflexion sur les grandes techniques nouvelles — dont il sentait la corrélation de plus en plus concrète et fondamentale avec les problèmes posés par le Tiers Monde tels que les aborde le C.R.M., problèmes auxquels il a consacré son talent et son humanisme — notamment dans*

le cadre de l'Organisation Mondiale de la Santé. Et puis nous savions que nous avions le même idéal : le respect de tous, c'est-à-dire le véritable respect de la personne. Il repose dans sa chère Lorraine, où il fut étudiant, professeur, doyen de la Faculté de Médecine de Nancy, d'où il partait pour son action internationale et où il revenait toujours retrouver le bon sens et la sagesse.

Nos camarades de travail et nous-mêmes, nous vous adressons l'expression de nos sentiments les meilleurs.



Docteur André GROS,
Président.



Georges GUÉRON,
Secrétaire Général.

Nous rappelons que les faits sélectionnés pour la première partie des bulletins du C.T.N. le sont moins pour leur valeur informative que pour leur signification. Ils ne tendent donc pas à présenter un intérêt documentaire pour les spécialistes : ils ne peuvent que les aider à réfléchir au delà de leur spécialité.

De la même manière, les textes sélectionnés pour la seconde partie des bulletins du C.T.N. sont choisis pour susciter la réflexion des lecteurs même s'ils sont parfois choquants. Ils ne reflètent donc pas nécessairement l'opinion des membres du bureau du C.T.N.

Première partie : Faits significatifs

I — ASTRONAUTIQUE

A. Recherches.

1. L'exploration de la lune.

La stupéfaction et l'admiration qui ont accueilli le lancement du premier satellite artificiel ont fait place, en dix ans, à une sorte d'indifférence. On s'est habitué à l'astronautique et des prouesses techniques telles que la correction de trajectoire de Surveyor V ou l'établissement d'une carte détaillée de la face cachée de la lune sont passées presque inaperçues.

• Le programme Surveyor qui comporte le lancement d'une série d'engins destinés à se poser sur la lune pour y procéder à diverses observations se poursuit dans des conditions assez satisfaisantes : les trois premiers ont été des réussites incontestables (cf. *Bulletin C.T.N.* n° 38, septembre 1966, p. 6 et n° 43, septembre 1967, p. 5). Le quatrième a cessé d'émettre quelques secondes avant de se poser sur la lune (C.T.N. n° 13.699) ; lancé en septembre, le cinquième a pu remplir sa mission d'analyse électro-chimique du sol lunaire malgré de graves incidents au cours de sa trajectoire. Ces incidents ont obligé les techniciens à recourir à une manœuvre de fortune pour ralentir suffisamment l'engin quelques secondes seulement avant qu'il ne se pose (*New Scientist*, 21 septembre 1967, C.T.N. nos 13.768, 13.796).

• Les cartes de la face cachée de la lune, publiées par les services de la NASA (National Astronautics and Space Administration) à l'occasion du XIIIe congrès de l'Union astronomique internationale (Prague, août 1967) ont été dressées à partir de documents photographiques transmis par les engins Lunar Orbiter ainsi que par l'engin soviétique Zond III (cf. *Bulletin C.T.N.* n° 34, novembre 1965, p. 5). Le cinquième et dernier engin de la série Lunar Orbiter doit permettre de compléter ce travail, beaucoup plus riche en détails que l'atlas dressé par les services soviétiques (*Le Monde*, 3 août 1967, 14 septembre 1967, C.T.N. nos 13.762, 13.764).

• Le satellite Explorer 35, lancé en juillet doit graviter autour de la lune pendant deux ou trois ans et étudier les radiations du milieu lunaire qui risqueraient de gêner la réalisation du programme Apollo (C.T.N. n° 13.698).

• Les premiers astronautes de la mission Apollo devront installer sur la lune des instruments scientifiques relativement sommaires pour effectuer les premières observations. Au cours d'une mission ultérieure, plus longue, ils devront établir une série de stations d'observation et de mesures et les relier à une station centrale qui communiquera avec la Terre (*New Scientist*, 24 août 1967, C.T.N. n° 13.792).

• Pour étudier le sous-sol de la lune, le Professeur Teller propose de procéder à une explosion nucléaire analogue aux explosions souterraines du programme Plowshare (*Sciences et Avenir*, août 1967, C.T.N. nº 13.784).

2. **Les recherches astronomiques.**

Lancer un satellite-observatoire sur la trajectoire d'une comète serait d'un intérêt scientifique considérable. C'est pourquoi la N.A.S.A. a commencé à étudier les comètes que l'on pourrait intercepter dans l'état actuel des techniques astronautiques. De même ce problème figure au programme de l'ESRO (European Space Research Organization) et, pour M. J. Strong, membre fondateur de la British interplanetary Society, il faudrait dès maintenant commencer à étudier la théorie d'une interception de la comète de Halley qui doit approcher du système solaire en 1986 (*New Scientist*, 10 août 1967, C.T.N. nº 13.793).

3. **Les recherches biologiques.**

• L'orientation de la croissance des végétaux serait directement déterminée par la pesanteur : les germes de blé placés à bord du biosatellite américain lancé en septembre 1967 semblent s'être développés normalement mais dans des directions inhabituelles (*New Scientist*, 28 septembre 1967, C.T.N. nº 13.766).

• Un enregistrement du rythme des pulsations cardiaques de la souris qui est directement proportionnel à la surcharge de l'accélération, pourrait servir de signal de la réaction-plafond à l'accélération (*Bulletin d'Information d'U.R.S.S.*, 15 juin 1967, C.T.N. nº 13.558).

• En demandant de relâcher les contraintes de stérilisation des engins spatiaux qui posent de difficiles problèmes d'engineering, deux chercheurs du Jet Propulsion Lab. ont suscité une vive inquiétude parmi les spécialistes réunis à Londres sous l'égide du COSPAR (Comité international de recherches spatiales) (*New Scientist*, 27 juillet 1967, C.T.N. nº 13.721).

B. **L'homme dans l'espace.**

• En vue du programme Apollo et surtout du projet Application Apollo qui comportera en particulier la mise sur orbite permanente d'appareils d'observations astronautiques, la N.A.S.A. a récemment recruté onze nouveaux cosmonautes. Contrairement à leurs prédécesseurs, ceux-ci n'ont encore aucune expérience aéronautique et ont été choisis d'abord en fonction de leur expérience ou de leur formation scientifiques (*Le Monde*, 6-7 août 1967, C.T.N. nº 13.770.)

• Après plusieurs jours de vol cosmique l'organisme humain répond aux conditions d'apesanteur par une déshydratation et une diminution de la masse musculaire et de la densité osseuse. Selon le Dr Egorov qui participa au vol de Voskhod 1, les cosmonautes pourraient s'adapter assez aisément à de tels changements. Mais le retour dans l'atmosphère et les surcharges d'accélération qu'il comporte, en ramenant brutalement l'organisme aux conditions normales pourraient provoquer des dérèglements irréversibles si l'on ne prend

pas des mesures particulières de protection, telles que l'absorption de médicaments spéciaux (qu'il faudrait étudier et mettre au point) ou la mise en hibernation des cosmonautes (qui reste rencore très hypothétique) (*Bulletin d'Information d'U.R.S.S.*, 19 septembre 1967 C.T.N. nº 13.782).

• Un accord d'assistance aux cosmonautes en danger a été soumis à l'approbation de la Commission des Nations Unies pour l'utilisation pacifique de l'espace (C.T.N. nº 13.967).

C. **Conséquences économiques.**

1. **Les télécommunications.**

• Les satellites de communication et plus particulièrement les satellites synchrones présentent un intérêt évident pour l'établissement d'un réseau mondial de télévision. Jusqu'à présent les émissions sont relayées, modulées et amplifiées par des stations au sol comme celle de Pleumeur-Bodou, en France ou celle de Goonhilly, en Grande-Bretagne. Mais lorsque la liaison émetteur-téléspectateur s'effectuera sans intermédiaire, une véritable mondovision ne sera possible que s'il existe un système uniforme de télévision (*Fiche EDMA*, 7 juin 1967).

• Les transmissions des futurs satellites stationnaires — qui ne peuvent opérer que sur une orbite déterminée, risquent d'être gravement perturbées par les émissions des stations de réception au sol. C'est pourquoi leur localisation devrait faire l'objet d'un programme d'ensemble rigoureux afin de préserver une « ressource naturelle qui est aussi précieuse que l'eau, le charbon ou le pétrole » (*New Scientist*, 14 septembre 1967, C.T.N. nº 13.788).

• L'exploitation des ressources minières dans les régions inhabitées du Canada dépend en grande partie d'un bon réseau de télécommunications, réalisable grâce aux satellites. C'est pourquoi le Canada envisagerait de lancer son propre satellite indépendamment du réseau Intelsat (*New Scientist*, 14 septembre 1967 C.T.N. nº 13.789 ; cf. *Bulletin C.T.N.* nº 40 janvier 1967, p. 8).

2. **La navigation.**

On commence à pouvoir chiffrer les incidences économiques de l'utilisation des satellites de navigation (cf. *Bulletin C.T.N.* nº 41, mars 1967, p. 8).

• Vers 1975, les économies réalisées pour l'ensemble de la flotte américaine seraient de l'ordre de 1 à 1,4 million de dollars et s'élèveraient à plus de 45 millions de dollars pour la seule navigation aérienne dans l'Atlantique Nord (*Recherche spatiale*, juin-juillet 1967 C.T.N. nº 13.785).

• Déjà une entreprise californienne fait des offres de services et propose d'établir un réseau de six satellites de navigation qui, moyennant 14.000 dollars (70.000 F) pour l'achat de l'équipement de réception des signaux et un abonnement annuel de 5.600 dollars (28.000 F), permettrait aux navigants de faire le point quelles que soient les conditions météorologiques (*New Scientist*, 21 septembre 1967, C.T.N. nº 13.798).

D. **Conséquences psychosociales et politiques.**

1. Les universitaires américains s'inquiètent de la politique astronautique pour les années 1970-1980. L'avenir de certains projets de recherche fondamentale semble compromis au profit de programmes de prestige comme les missions de reconnaissance vers Mars ou Vénus ou comme le projet Apollo. Pour ce dernier projet, d'ailleurs, tout l'effort porte sur l'envoi d'hommes sur la lune et la proposition de placer un détecteur de particules à bord de la capsule a été refusée parce que cela n'impliquait pas de travail pour l'équipage. Par ailleurs les stations de réception au sol semblent insuffisantes et sont désormais tellement surchargées qu'il a fallu réduire au quart la réception des signaux émis par des satellites de recherches comme Pionnier VI et VII (R.S. Lewis, *Bulletin of the atomic Scientist*, mai 1967).

2. Alors que, pour la première fois, une personnalité soviétique, le Professeur Sedov, évoquait la possibilité d'une coopération internationale pour les recherches spatiales (*Le Monde*, 6 septembre 1967, C.T.N. n° 13.771), l'Allemagne et la Grande-Bretagne indiquaient que la réalisation de leurs programmes nationaux les obligeait à limiter leurs contributions respectives aux projets européens (*New Scientist*, 10 août 1967, C.T.N. n^{os} 13.769, 13.794).

II — BIOLOGIE

A. **Biologie moléculaire.**

1. L'étude des différents constituants de la cellule vivante permet d'avancer des hypothèses non seulement sur sa structure et son fonctionnement mais aussi sur son origine. C'est ainsi que, selon des travaux présentés au VII^{e} Congrès de Biochimie (Tokyo, août 1967) les chloroplastes et les mitochondries, responsables de l'apport énergétique des cellules végétales et animales, seraient d'origine bactérienne. Leur présence serait le résultat d'une étroite symbiose devenue héréditaire (*Chemical and Engineering news*, 28 août 1967, C.T.N. n° 13.837 ; *New Scientist*, 28 septembre 1967, C.T.N. n° 13.843).

• On connaît encore mal la structure des ribosomes où s'effectue la synthèse des protéines sous l'action de l'A.R.N. (acide ribonucléique). Cependant, plusieurs équipes de chercheurs ont réussi d'une part à les cristalliser et à établir leur composition, d'autre part à préciser la localisation, en profondeur, de la synthèse des protéines (*New Scientist*, 13 juillet 1967, C.T.N. n° 13.707 ; *Scientific American*, septembre 1967).

• Des chercheurs britanniques et norvégiens ont récemment mis en évidence que les chalones, substances chimiques qui induisent la division des cellules animales, ont une action spécifique sur les tissus mais non sur les espèces : la même chalone agit sur l'épiderme du cobaye et sur celui de la souris mais est inopérante sur le tissu hépatique ou sur l'hypoderme de l'un ou de l'autre (*Scientific American*, juillet 1967).

2. De nombreuses recherches en cours sur les constituants cellulaires pourraient avoir d'importantes implications thérapeutiques :

• Ainsi, les troubles irréversibles que présentent les animaux de laboratoire après une exposition prolongée dans une atmosphère à 100 % d'oxygène seraient dus à une rupture des parois des lysosomes de certaines cellules pulmonaires, (cf. *Bulletin C.T.N.* n° 34, novembre 1965, p. 9) : ceux-ci libèrent en effet un enzyme qui détruit le contenu cellulaire. On s'efforce maintenant de déterminer les substances susceptibles de renforcer la membrane du lysosome ; ces recherches sont particulièrement intéressantes pour prévenir les troubles des cosmonautes contraints à vivre en atmosphère d'oxygène (*New Scientist*, 21 septembre 1967, C.T.N. n° 13.819).

• De même, les recherches portant sur l'interféron qui, dans la cellule, induit la libération des anticorps et lui permet de lutter contre l'infection, ont mis en évidence que sa production pouvait être déclenchée par des molécules purifiées d'A.R.N. ou par des extraits bactériens (*Médecine et Hygiène*, 19 avril 1967, C.T.N. n° 13.336 ; *New Scientist*, 25 mai, 10-17 août 1967, C.T.N. n^{os} 13.470, 13.812, 13.817).

3. Les progrès de la biologie moléculaire permettent de comprendre l'action de certains agents nocifs à un niveau plus élémentaire de l'organisme, celui des molécules.

• On a ainsi constaté que l'absorption de LSD s'accompagnait d'anomalies de l'appareil chromosomique et que, injecté à des rates au début de la gestation, il provoquait l'avortement ou une forte proportion d'anomalies dans les portées (*Science*, U.S.A., 21 juillet 1967 ; *New Scientist*, 3 août 1967, C.T.N. n° 13.815 ; cf. *Bulletin C.T.N.* n° 43, septembre 1967, p. 9).

• Selon des recherches récentes les radiations ne provoqueraient pas de modifications apparentes sur les différents composants de la cellule ; elles agiraient sur le métabolisme et bouleverseraient les interactions des différentes organelles cellulaires (*New Scientist*, 10 août 1967, C.T.N. n° 13.816).

4. Malgré ses développements spectaculaires, la biologie moléculaire ne faisait encore l'objet d'aucun enseignement officiel en Europe. Un accord vient d'être conclu entre l'Université de Californie et le Laboratoire international de Génétique et de Biophysique pour créer à Naples une Ecole supérieure de Biologie moléculaire dont le programme d'études, réparti sur trois ans, aboutira au niveau du doctorat (Ph. D.) (*Science*, U.S.A., 23 juin 1967, C.T.N. n° 13.824).

B. **Biologie médicale.**

1. **Les greffes et les organes artificiels.**

• Les techniques de transplantation d'organes et les mécanismes de rejet des greffes ont fait l'objet d'un important Congrès international qui s'est tenu à Paris du 25 au 30 juin 1967. Jusqu'à présent seules les greffes de reins ont été durables (cf. *Bulletin C.T.N.* n° 42, juillet 1967, p. 11). Les rares essais de greffes de foie, de pancréas et même de poumon ont

tous été négatifs chez l'homme, alors qu'une proportion appréciable d'expériences sur les animaux de laboratoire a été couronnée de succès (*Presse quotidienne*, 28-30 juin 1967, C.T.N. n° 13.634).

• A cet égard un progrès notable a été réalisé par un chirurgien britannique qui, travaillant sur des lapins d'espèces différentes, a réussi à désensibiliser l'organisme récepteur en lui injectant au préalable des fragments d'antigènes prélevés sur le foie du donneur éventuel (*New Scientist*, 20 juillet 1967, C.T.N. n° 13.841).

• Par ailleurs les expérimentateurs ont constaté à plusieurs reprises, sans pouvoir encore en donner d'explication, que la greffe de peau entre animaux d'une même portée était rapidement rejetée alors que le foie transplanté pouvait continuer à fonctionner pendant plusieurs mois (*New Scientist*, 25 mai 1967, C.T.N. n° 13.471).

• Une technique récemment mise au point en Allemagne de l'Ouest permettrait d'utiliser des greffons de tendons prélevés sur des cadavres et conservés à zéro degré dans une solution qui ne préserve que les fibres de collagène. Celles-ci, peu antigéniques, sont plus aisément tolérées par le receveur que des tissus frais (*Médecine et Hygiène*, 26 avril 1967, C.T.N. n° 13.330).

• Afin de promouvoir les recherches sur les « cœurs artificiels », le gouvernement américain a conçu un programme calqué sur celui des engins spatiaux : formation massive de personnel hospitalier hautement spécialisé et contrats de recherches avec des entreprises privées pour la réalisation des appareils (*Gazette médicale*, 5 mai 1967, C.T.N. n° 13.567).

2. **Le cancer.**

• Il n'est pas impossible que la cancérisation s'accompagne d'anomalies chromosomiques. Celles-ci ont été décelées dans la plupart des tumeurs cancéreuses; mais, sauf pour certains cas de leucémie, aucune de ces anomalies n'a pu être clairement identifiée. Cependant comme les études ont toujours été faites sur des tumeurs avancées, on peut se demander si un examen précoce des tissus ne permettrait pas de découvrir des modifications spécifiques qui se trouveraient ultérieurement « noyées » dans la masse des anomalies secondaires (*Médecine et Hygiène*, 5 avril 1967, C.T.N. n° 13.496).

• En éliminant la phénylalanine de la ration alimentaire de malades atteints de tumeurs cancéreuses graves, deux médecins américains ont constaté une notable réduction des tumeurs dans la moitié des cas (*Informations et Documents*, 1er juillet 1967, C.T.N. n° 13.667).

• La croissance et la multiplication anarchique des cellules cancéreuses pourraient être dues à la destruction d'un inhibiteur de croissance (cf. *Bulletin C.T.N.* n° 39, novembre 1966, p. 11 et n° 40, janvier 1967, p. 9). La cellule contiendrait deux composés, la promine (qui *pro*voque la croissance) et la retine (qui la *ret*arde) dont l'action conjuguée assure normalement l'évolution et la croissance. Or le Professeur Szent-Gyorgyi qui poursuit ces recherches depuis plusieurs années a toujours trouvé de la retine en excès dans les tissus sains ; l'équilibre se trouve rompu dans les tissus cancéreux qui manquent de retine. Ce corps serait relativement facile à synthétiser : en admettant qu'il soit assimilable, on disposerait ainsi d'un agent chimique pour enrayer le développement des tumeurs malignes (*Science*, U.S.A., 3 février 1967; *New Scientist*, 11 mai 1967, C.T.N. n° 13.375).

C. **L'Océanographie.**

Les recherches et les activités océanographiques ne cessent de se développer et d'attirer l'attention d'un grand nombre de responsables. Il est d'ailleurs significatif qu'un périodique bimensuel *Oceanology International*, compte plus de 20.000 abonnés au bout de sa première année d'existence (*The Futurist*, avril 1967).

1. Les incidences économiques sont nombreuses :

• En France, où un Centre national pour l'Exploitation des Océans (CNEXO) a été récemment créé, une société technique pour l'océanologie s'est constituée sous le nom de « Technocéan », pour la construction du matériel nécessaire au travail en mer (*Diagrammes*, avril 1967, C.T.N. n° 13.555).

• Aux Etats-Unis, un millier d'entreprises consacrent la totalité ou une partie de leurs activités à l'Océanographie ; une cinquantaine d'entre elles figurent parmi les cinq cents entreprises américaines les plus importantes ; et celles qui s'intéressent à la plupart des problèmes d'équipements et de matériels de recherches sont, à côté des entreprises à vocation marine, des sociétés plus ou moins spécialisées dans la construction aérospatiale (*International Science and Technology*, avril 1967). Un commentateur économique de l'*Evening Star* (21 septembre 1966) prévoyait des dizaines de milliers d'emplois nouveaux dans ce domaine (cité par *The Futurist*, avril 1967).

2. Peut-être faut-il mentionner ici des propositions vigoureusement soutenues au cours de la dernière conférence du Mouvement de Pugwash (cf. ci-dessous, deuxième partie, Texte IV) par le Professeur Sohn : il s'agirait de constituer, sur les recettes à provenir de l'exploitation de l'espace ou des océans, un fonds destiné à alimenter en « ressources propres » des organismes mondiaux comme par exemple l'O.N.U.

3. On lira avec le Texte I (deuxième partie) les principales notions qui se dégagent de plusieurs études publiées à ce sujet au cours des derniers mois.

D. **Les problèmes d'alimentation.**

Plusieurs voies de recherche sont explorées pour améliorer la production alimentaire.

• En U.R.S.S. des croisements de végétaux ont abouti à des cultures d'hybrides qui, dans les stations expérimentales, auraient produit jusqu'à 200 kg de matière comestible par mètre carré et par an (*New Scientist*, Courrier des lecteurs, 24 août 1967, C.T.N. n° 13.813).

• La teneur en protéines d'un certain nombre de céréales a pu être considérablement augmentée en laboratoire par l'injection d'une substance phytopharmacologique qui stimule la production des enzymes nécessaires à la synthèse des acides aminés (*Sciences et Avenir*, août 1967, C.T.N. n° 13.828).

• Une entreprise américaine aurait réussi à « synthétiser de la viande » à partir de protéines végétales et de graisses animales (*New Scientist*, 6 juillet 1967, C.T.N. nº 13.682).

• Il serait particulièrement intéressant de pouvoir déterminer à l'avance le sexe des animaux domestiques en fonction des besoins. Les travaux poursuivis à cet égard en Allemagne et en Grande-Bretagne, valables pour les lapins et les cobayes, n'ont cependant pas encore donné de résultats pour le gros bétail (*New Scientist*, 7 septembre 1967, C.T.N. nº 13.806).

E. **La pollution.**

Dans les pays industrialisés, la pollution des eaux et de l'atmosphère est devenue un problème majeur et les recherches se font de plus en plus nombreuses soit pour améliorer les méthodes de détection, soit pour lutter directement ou non contre des dangers présents ou futurs.

1. En raison de l'expérience acquise pour l'étude de la dispersion des particules radioactives, le Centre nucléaire de Harwell vient d'être chargé par le Gouvernement britannique d'entreprendre des recherches sur la pollution atmosphérique ainsi que sur l'effet des polluants sur les voies respiratoires (*New Scientist*, 24 août 1967, C.T.N. nº 13.801).

• L'intensité lumineuse émise par de nombreux micro-organismes varie en présence de certains composés chimiques dans le milieu ambiant et pourrait être utilisée pour détecter et mesurer leur taux de concentration (*New Scientist*, 20 juillet 1967, C.T.N. nº 13.712).

• Les appareils ultra-sensibles mis au point pour les recherches astronautiques pourraient être adaptés et utilisés à la détection de particules nocives en suspension dans l'atmosphère (*Diagrammes*, juillet 1967, C.T.N. nº 13.825 ; cf. *Bulletin C.T.N.* nº 42, juin 1967, p. 14).

2. Depuis une vingtaine d'années huit Etats de la vallée de l'Ohio ont constitué une association pour lutter contre la pollution de leurs rivières et semblent avoir obtenu d'intéressants résultats en prenant un certain nombre de mesures d'ordre technique mais surtout en s'efforçant de définir les tolérances acceptables et d'en informer largement les membres de l'association, dont la plupart sont des industriels ou des groupes d'industriels (*N.A.M. Report*, 21 août 1967, C.T.N. nº 13.744).

Cependant beaucoup de polluants chimiques résistent à la destruction microbienne et de nombreux détergents et insecticides peuvent persister dans le sol des années après qu'on ait cessé de les utiliser. Certains composés semblent totalement « récalcitrants », d'autres ne le sont que dans certaines conditions du milieu. La « récalcitrance » peut avoir une origine chimique ou physique qui justifierait des recherches systématiques (*New Scientist*, 31 août 1967, C.T.N. nº 13.807).

A plus long terme, les recherches entreprises pour développer la production d'énergie « propre » peuvent s'inscrire dans un programme de lutte contre la pollution. Ainsi des

chercheurs de Lockheed Aircraft Corp. proposent d'utiliser les combustibles fossiles non plus en tant que tels mais pour synthétiser un combustible propre qui pourrait être l'ammoniac dont la combustion dégage de l'azote et de l'eau (*Scientific American*, août 1967).

La mise au point de piles électriques ou à combustible pour la propulsion des voitures aurait le double avantage de les rendre silencieuses et d'éviter le dégagement de gaz nocifs (*Nucleus*, 1967, C.T.N. n° 13.728).

III — CALCUL, CYBERNÉTIQUE, ÉLECTRONIQUE

A. **Recherches.**

1. Les lasers et leurs applications.

• L'extrême sensibilité du laser en fait un instrument de choix pour les mesures de haute précision. Des chercheurs berlinois ont pu mesurer des longueurs au 10^{-11} cm et des indices de réfraction avec une précision de 10^{-13} (1re Conférence internationale sur les applications des lasers, Paris, juillet 1967, C.T.N. nos 13.713, 13.719).

• La technique des hologrammes qui dérive directement de la mise au point des lasers (cf. *Bulletin C.T.N.* n° 35, janvier 1967, p. 13), ouvre la voie vers la microscopie à trois dimensions (*New Scientist*, 13 juillet 1967, C.T.N. n° 13.684), comme vers une conception nouvelle, pour les calculateurs, de mémoires ultra-rapides dont les supports ne seraient plus des microphotographies mais des micro-hologrammes (C.T.N. n° 13.760).

2. Dans le domaine médical, les expériences et les projets se multiplient soit pour automatiser la surveillance des malades dans les hôpitaux (C.T.N. n° 13.705) soit pour l'exploitation des dossiers médicaux déjà réalisée aux Etats-Unis et au Danemark et actuellement à l'étude en France (La médecine et l'intelligence artificielle, Paris, 7 mars 1967, C.T.N. n° 13.631), et en Grande-Bretagne (*New Scientist*, 3 août 1967, C.T.N. n° 13.747).

3. Les recherches sur les machines capables de « convertir » l'information se multiplient : une machine qui transcrit automatiquement en braille les caractères transmis par une machine à écrire ordinaire fonctionne en time-sharing entre le M.I.T. (Massachusetts Institute of Technology) et une vingtaine d'institutions de jeunes aveugles ; au M.I.T. également, une machine qui transcrit les caractères imprimés en son codé est en cours d'expérimentation (*New Scientist*, 31 août 1967, C.T.N. n° 13.803).

Relevant du processus inverse, le prototype d'une machine sensible à la voix et qui répartit les paquets selon les numéros de code dictés par l'employé du tri postal est en cours de construction dans les laboratoires de Radio Corporation of America (*New Scientist*, 7 septembre 1967, C.T.N. n° 13.804).

B. **Conséquences économiques et psychosociales.**

1. Selon un récent rapport du Comité scientifique consultatif de la Maison Blanche, les ordinateurs seront avant dix ans un instrument indispensable à l'enseignement supérieur comme au fonctionnement des bibliothèques.

• L'équipement de l'ensemble des institutions américaines reviendrait à 400 millions de dollars par an, soit environ 60 dollars par étudiant ; or, actuellement on estime que les installations et le fonctionnement des bibliothèques et services annexes reviennent en moyenne à 125 dollars par étudiant et par an (*Science*, U.S.A., 7 avril 1967 ; *Amérique actuelle*, juillet-août 1967, C.T.N. n° 13.743).

• Cela implique cependant qu'un certain nombre de problèmes soient résolus ; en particulier, si de tels systèmes ont déjà fait leurs preuves pour l'indexation des références et leur diffusion (cf. *Bulletin C.T.N.* n° 43, septembre 1967, p. 12). Il n'en est peut-être pas de même pour la bibliothéconomie, où nombre d'opérations sont encore mal définies et où certains caractères du catalogage sont devenus si familiers qu'on pourrait négliger d'en tenir compte en les introduisant dans le programme de la machine. Par ailleurs, l'automatisation de la bibliothèque et surtout sa consultation à distance peuvent paralyser les initiatives du chercheur (*New Scientist*, 20-27 juillet 1967, C.T.N. n^{os} 13.717, 13.718).

2. L'équipement en « time-sharing » commence à être opérationnel en Europe : un dispositif mis en place à Londres par General Electric permet de traiter une quarantaine de problèmes à la fois et d'être branché sur cent cinquante « terminaux » (*New Scientist*, 31 août 1967, C.T.N. n^{os} 13.759, 13.802).

Mais le système deviendra beaucoup plus complexe avec l'augmentation du nombre des utilisateurs et le besoin d'un langage, valable à la fois pour la machine et pour chacun des usagers. De sorte qu'une grande partie des bénéfices escomptés par les fabricants d'ordinateurs risque d'être absorbée par le coût de plus en plus élevé du software (*New Scientist*, 3-17 août, C.T.N. n^{os} 13.746, 13.811).

C. **La cybernétique.**

La cybernétique tend à s'ériger en science des systèmes qui attire un nombre croissant de chercheurs de formation scientifique autant que sociologique, économique ou philosophique.

1. On commence à percevoir les signes d'une telle évolution :

• Au plan pratique, l'académicien ukrainien Gloukov la décrit ainsi : « Il s'agit surtout « de créer des systèmes de commande, représentant un ensemble de machines et de méthodes « permettant d'automatiser entièrement telle ou telle sphère de la production, de l'agricul- « ture, de l'économie jusqu'à des échelles nationales très grandes » (*Nouvelles de Moscou*, 19 août 1967, C.T.N. n° 13.752).

• Au début de juillet, M. Kendall, ancien Professeur de statistiques à l'Université de Londres, a organisé un symposium afin de réunir un certain nombre de personnalités dont le seul point commun était d'essayer de comprendre les choses « complexes ou insolites en établissant leurs modèles mathématiques et logiques ». L'affluence et la qualité des participants indiquent bien qu'une telle confrontation répondait à un besoin réel (*New Scientist*, 9 juillet 1967, C.T.N. n° 13.711).

• Les statuts de l'association sans but lucratif, Data Processing Management Association, récemment créée en Grande-Bretagne, stipulent expressément que seuls pourront en faire partie ceux qui ont acquis une expérience pratique en matière d'intégration (management) des ordinateurs (*New Scientist*, 13 juillet 1967, C.T.N. n° 13.681).

2. Le Texte II (deuxième partie) est le compte rendu du V^e^ Congrès international de Namur établi par Georges et Jeannine Guéron à l'intention des membres du C.T.N.

IV — ÉNERGIE

Energie atomique.

A. Recherches.

1. Les accélérateurs de particules.

• Le projet de construire un accélérateur géant de 300 GeV en Europe suppose une coopération internationale scientifique et technique qui a d'ailleurs déjà fait ses preuves au Centre européen de Recherches nucléaires (C.E.R.N.) de Genève. Si le projet est adopté, le choix de son emplacement posera évidemment des problèmes d'ordre politique et financier mais devra en outre répondre à un certain nombre d'exigences :

— d'ordre purement technique, comme la constitution géologique du terrain sur lequel il sera édifié ;

— d'ordre économique et psychosocial, comme le degré d'équipement de la région et le temps moyen d'absence pour les personnes qui, venues des différentes capitales d'Europe, devraient participer à une réunion d'une journée sur le site de l'accélérateur (*Le Monde*, 21 septembre 1967, C.T.N. n° 13.877).

• L'accélérateur géant de 70 GeV de Serpoukhov en voie d'achèvement aux environs de Moscou, prend les dimensions d'une véritable ville industrielle (*Bulletin d'Information d'U.R.S.S.*, 14 septembre 1967, C.T.N. n° 13.754).

2. Les batteries radio-isotopiques.

Huit pays membres de l'Agence européenne pour l'Energie nucléaire vont entreprendre en commun un programme de recherches pour mettre au point de petits générateurs élec-

triques alimentés par radio-isotopes. De dimensions réduites et de faible puissance, de telles « batteries » sont particulièrement intéressantes pour leurs applications médicales et télémétriques (*Diagrammes*, juillet 1967, C.T.N. n° 13.826).

B. Conséquences économiques et utilisations pacifiques.

1. La production d'uranium.

• En prévision d'une augmentation de la demande d'uranium au cours des vingt prochaines années, le Canada se propose d'intensifier son effort de prospection (*Energie nucléaire*, juin-juillet 1967, C.T.N. n° 13.677).

• L'Institut nucléaire de Chine populaire vient de mettre au point un appareil qui permet de détecter plus finement et plus rapidement les gisements d'uranium et de thorium (id. C.T.N. n° 13.678).

• Un contrat d'enrichissement d'uranium a été récemment conclu entre l'Atomic Energy Commission (U.S.A.) et une entreprise privée suédoise pour l'approvisionnement d'une centrale de 400 MW. Ce contrat qui prévoit la fourniture de 10.000 kg d'U. 235 légèrement enrichi entrera en vigueur au 1er janvier 1969 (*New Scientist*, 6 juillet 1967, C.T.N. n° 13.685).

2. La production d'électricité.

• Un réacteur nucléaire d'une puissance de 10.000 kW de dimensions assez réduites pour être embarqué à bord d'un Liberty ship, vient d'être mis au point par une entreprise américaine (*Sciences et Avenir*, août 1967, C.T.N. n° 13.827).

• Pour être rentables les installations de dessalement de l'eau de mer fonctionnant à l'énergie atomique doivent être en même temps productrices d'électricité. Les plus récents calculs font espérer, pour une centrale de 600 MW, les prix de 2 mills (1 centime) le kWh et de 10 cents les 1.000 gallons (13,5 centimes les 1.000 litres) (Prof. A. Weinberg, XVIIe Conférence Pugwash, Ronneby, 3-11 septembre 1967).

3. L'emploi des radiations.

• L'utilisation des radiations pour la stérilisation des denrées alimentaires reste soumise à controverse : la Grande-Bretagne entend en contrôler plus étroitement la vente alors que les Etats-Unis se proposent d'en étendre l'emploi à la conservation des volailles (*Energie nucléaire*, juin-juillet 1967, C.T.N. n° 13.679 ; *New Scientist*, 21 septembre 1967, C.T.N. n° 13.818).

• Un laboratoire australien a mis au point une méthode d'irradiation qui permet de contrôler le développement et la qualité de la laine en fonction de la nutrition des moutons (*New Scientist*, 6 juillet 1967, C.T.N. n° 13.680).

On trouvera sous les rubriques suivantes un choix de faits significatifs qui ne relèvent pas toujours directement des grandes techniques nouvelles. Mais ils se rapportent à une expression, un esprit ou une forme de pensée qui rejoignent les caractéristiques de dimensions, de rapidité d'évolution ou de complexité que ces grandes techniques imposent au monde moderne.

I. — ENSEIGNEMENT, ÉDUCATION, CULTURE

A. Les techniques pédagogiques.

1. Les moyens audio-visuels.

• Au Congrès de l'Union nationale des Professeurs de Grande-Bretagne, le ministre de l'Education nationale a annoncé la création d'un Conseil national de Technologie éducative chargé de conseiller les services responsables de l'instruction scolaire ou professionnelle sur l'emploi des moyens audio-visuels. Par ailleurs des cours spéciaux sont organisés aux environs de Londres à l'intention des professeurs qui désirent préparer des cours pour la télévision éducative (*The Observer*, 26 mars 1967, C.T.N. n° 13.695).

• Les premières expériences de télévision en circuit fermé dans les établissements scolaires français semblent assez satisfaisantes malgré les difficultés inhérentes à des méthodes encore tâtonnantes mais qui, de l'avis de plusieurs professeurs les obligent à sortir de leur isolement pédagogique, à confronter leurs expériences et à pratiquer pour certaines matières un véritable enseignement en équipe (*Le Monde*, 5 septembre 1967, C.T.N. n° 13.773).

• Cependant ces expériences sont encore pratiquement ignorées du grand public ; on a pu le constater notamment au Salon international de la radio et de la télévision (Paris, 1-10 septembre 1967) où celles-ci étaient présentées presque exclusivement comme instruments de loisir et de détente (C.T.N. n° 13.742).

2. Education et monde moderne.

• Les « mass media » constituent une véritable « école parallèle » dont tout système pédagogique se devrait de tenir compte. Mais il est très difficile de passer en cette matière du « Moyen Age à l'ère des communications spatiales » (*New Scientist*, 13 juillet 1967, C.T.N. n° 13.683).

• Préparer l'enfant et surtout l'adolescent à vivre dans un monde qui n'aura peut-être rien de commun avec le nôtre est une tâche difficile pour laquelle M. R. Colborn, rédacteur en chef de *International Science and Technology* (juillet 1967) propose sept matières fondamentales réparties de la façon suivante :

— 5 % du temps serait consacré aux mathématiques, cet « outil essentiel à une société qui manipule des symboles » ;

— 5 % à un travail manuel pour apprendre à « se défendre contre une manipulation excessive de ces symboles » ;

— 10 % à l'étude du passé, de son évolution vers le présent, de sa projection vers l'avenir ;

— 15 % aux arts et à la littérature, valeurs éternelles ;

— 15 % à l'analyse de la société et à l'étude des institutions politiques, administratives, économiques ;

— 10 % à une connaissance générale des principaux phénomènes scientifiques ;

— enfin tout le reste du temps, soit 40 % à « apprendre à apprendre », par exemple à lire un livre, à se servir d'une bibliothèque, à prendre des notes...

B. **L'Information et la Vulgarisation.**

Personne ne nie plus la nécessité d'informer le public et nombreux sont les hommes de science comme les « hommes d'information » qui prennent conscience de leur responsabilité à cet égard, en même temps que de la difficulté de la tâche.

1. A la XVII[e] Conférence de Pugwash (Ronneby, 3-8 septembre 1967 ; cf. ci-dessous, deuxième partie, Texte IV) M. Nigel Calder, ancien directeur de *New Scientist*, devait dénoncer une attitude trop passive de la part des savants à l'égard de la vulgarisation : en général, les savants acceptent assez volontiers d'expliquer leurs travaux mais ils le font rarement spontanément et ils attendent, le plus souvent, d'y être invités par un éditeur ou par un journaliste. Or, informer le public devrait faire partie de leur métier au même titre que la recherche.

Cette tâche, le Professeur Rabi, prix Nobel de Physique, en reconnaissait l'importance et cherchait à la définir dans une conférence dont on lira un extrait en deuxième partie (Texte III).

2. Ces efforts se concrétisent parfois :

• L'Association française des Journalistes scientifiques encourage les relations entre journalistes qualifiés et attachés de presse des différents organismes scientifiques et techniques et s'efforce de créer une Union internationale des Journalistes scientifiques (*Le Progrès scientifique*, septembre 1967).

• Aux Etats-Unis, un Comité pour l'Information de l'Environnement, fondé en 1958, édite sous l'égide de l'Institut des Savants pour l'Information du public, un périodique, *Scientist and Citizen*, à l'intention du lecteur « intelligent sans connaissances scientifiques particulières ». Au comité d'abord, à la rédaction du journal ensuite, les hommes de science ont pris l'habitude de confronter leurs opinions et leurs connaissances avec des non scientifiques ayant souvent certaines responsabilités politiques ou administratives. La règle est de s'efforcer de donner une information objective sans jugement politique (*Scientific American*, juillet 1967 ; *Science*, U.S.A., 25 août 1967, C.T.N. n° 13.822).

II. — SCIENCE ET SOCIÉTÉ

A. **La Recherche fondamentale.**

• En 1967, l'U.R.S.S. compte plus de 700.000 chercheurs (dont 273.000 femmes) contre 98.000 en 1940. La moitié d'entre eux ont soutenu leur thèse de doctorat au bout de trois ans de formation spécialisée ; pendant cette « aspiranture » ils suivent en outre des cours de philosophie, de langues étrangères et de mathématiques et sont tenus de faire un stage pédagogique (*Nouvelles de Moscou*, 15 juillet 1967, C.T.N. nº 13.731).

• Le Japon se propose de construire une cité scientifique à l'image de la cité soviétique d'Academgorod, voisine de Novosibirsk (*New Scientist*, 17 août 1967, C.T.N. nº 13.805 ; *Bulletin C.T.N.* nº 43, septembre 1967, p. 22).

B. **La Recherche - Développement.**

• Le gouvernement français a décidé de créer une Agence nationale de Valorisation de la Recherche (ANVAR) afin d'encourager et de développer la coopération entre la recherche publique et l'industrie privée (*Sciences*, France, mars-avril 1967).

• Cependant aux Etats-Unis on évalue à 10 % à peine le nombre des brevets exploités par l'industrie privée à partir de la recherche publique. Par contre l'impact, sur le secteur privé, des recherches entreprises dans des organismes comme l'Atomic Energy Commission ou la N.A.S.A., se manifeste largement non pas sous forme de techniques ou de produits nouveaux, mais de méthodes de travail et d'exigences de perfection (*Atomes*, juin 1967, C.T.N. nº 13.586).

• Sous le sigle CODSIA, un Conseil des associations de l'industrie spatiale et de la défense (parmi lesquels les syndicats professionnels des industries automobiles, électroniques et nucléaires) a été constitué aux Etats-Unis afin de mettre en commun leur expérience pour l'établissement des contrats de recherches techniques avec les agences gouvernementales (*N.A.M. Reports*, 17 juillet 1967, C.T.N. nº 13.735).

C. **L'émigration des cerveaux ou « brain-drain ».**

Le « brain-drain » vers les Etats-Unis qui a fait l'objet d'un colloque international récent (Lausanne, août 1967) prend des proportions inquiétantes pour beaucoup de nations et plus particulièrement pour le Canada, la Grande-Bretagne et les pays d'Asie. Parmi les mesures qui pourraient être prises pour enrayer cette ponction dramatique surtout pour les pays en voie de développement on a proposé de développer les services de relations entre les scientifiques de différents pays, d'assouplir les structures de la recherche, de promouvoir les programmes d'assistance non seulement en fonction des qualifications des experts mais aussi de leur nationalité : les pays pauvres devraient recevoir comme experts ceux de leurs ressortissants qui ont acquis ailleurs leur qualification (Cerveaux à vendre, *Le Monde*, 24-29 août 1967, C.T.N. nº 13.779 ; cf. *Bulletin C.R.M.* nº 19, octobre 1967, p. 15-16).

D. **La responsabilité des savants.**

La plupart des problèmes évoqués ci-dessus sont des sujets de préoccupation grave pour de nombreux hommes de science et notamment pour les membres du Mouvement de Pugwash. A l'occasion du X^{e} anniversaire de la création du Mouvement (cf. *Bulletins C.T.N.*, n° 10-11, octobre-novembre 1962, Textes III et VI ; n° 12, décembre 1962, Texte I ; n° 30, janvier 1965, p. 22 ; n° 40, janvier 1967, p. 12 et 19, etc.), une vaste rencontre a été organisée à Ronneby (Suède) ; on en lira le compte rendu dans la deuxième partie du présent bulletin (Texte IV).

E. **Le monde de demain.**

1. Sur une centaine d'innovations réalisables en l'an 2000, le Professeur Hermann Kahn, Directeur de Hudson Institute, estime que vingt-cinq, parmi lesquelles la prévision météorologique à long terme, l'élimination de certaines maladies ou malformations congénitales, la création de nouvelles espèces de plantes ou d'animaux mieux adaptés aux besoins des hommes, la photographie et le cinéma en relief, seront acceptées sans discussion. D'autres, par contre, seront « controversées » ; autrement dit, on préférerait qu'elles ne se réalisent pas à cause de leurs implications sociales ou politiques. Telles sont : le contrôle du climat une hibernation prolongée des hommes, des techniques de contrôle des naissances très bon marché et très faciles à appliquer, le choix du sexe des enfants, un allongement considérable de la vie, etc. (*Chemical and Engineering News*, 10 avril 1967).

2. Dire ou écrire que les pays industrialisés évoluent vers une civilisation des loisirs pour laquelle ils ne sont guère préparés est presque devenu un lieu commun. Il est cependant significatif que les pays en voie de développement s'en préoccupent dès aujourd'hui et qu'un important colloque sur « Temps libre et récréation » ait été organisé à La Havane (*Atomes*, mars 1967, C.T.N. n° 13.359).

3. La « futurologie » commence à s'ériger en véritable discipline avec ses groupes d'études, ses spécialistes, ses cours de formation...

- Un cours sur le « 21^{e} siècle » est organisé dans un Collège de Floride. A l'occasion de discussions par petits groupes, les élèves sont invités à extrapoler les tendances présentes et à imaginer les réalisations possibles ou probables.

- Le gouvernement américain encourage la création de centres de recherches qui sont chargés d'étudier les besoins et les moyens d'action d'une « école de prévision technologique » (*The Futurist*, avril 1967).

- Sous le titre « Histoire et Futurologie » (1), M. O.K. Flechtheim à récemment publié une série d'articles dont plusieurs datent de plus de vingt ans. Qu'ils aient trait à l'enseignement ou à la prévision, qu'ils décrivent des événements historiques ou les institutions politiques, tous contribuent à définir cette notion de « futurologie » (le terme a été inventé par l'auteur) et à montrer comme le dit fort bien M. Robert Jungk dans sa préface, que « le symbole des temps futurs sera un réseau bien plus qu'une flèche ».

- Le Texte V (deuxième partie) illustre l'ensemble de ces tendances.

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(1) Verlag Anton Hain, Meisenheim am Glan, ed. 1966.

Deuxième partie : Textes significatifs

TEXTE N° I

L'exploitation des ressources océanographiques (analyse).
Bulletin of the atomic Scientists, décembre 1964, *avril* 1967.
International Science and Technology, avril 1967.
The Futurist, avril 1967.

L'Océanographie, discipline-carrefour par excellence où doivent étroitement collaborer hommes de science de différents horizons, techniciens et artisans, pose des problèmes d'ordre politique et juridique aussi bien que d'ordre technique ou biologique.

Les ressources alimentaires sont encore loin d'avoir été inventoriées ou exploitées jusqu'à présent. Si l'on parvenait à organiser sur une vaste échelle l'élevage du poisson, on pourrait probablement centupler les tonnages actuellement capturés. Les méthodes qui ont fait leurs preuves pour améliorer le rendement agricole pourraient — et commencent à — être transposées à « l'aquaculture ». Ainsi pourrait-on imaginer d'isoler certaines espèces de poissons afin de les élever plus rationnellement, par des barrières chimiques, acoustiques, électriques. On sait déjà que certaines épaves constituent des lieux de pêche favorisés et aux Etats-Unis plusieurs entreprises coulent délibérément des matériaux de toutes sortes (bidons, bouteilles, carcasses de voitures, etc.) pour constituer des récifs artificiels à l'abri desquels certaines espèces de poissons viennent se protéger de leurs prédateurs naturels.

De même on peut envisager de fertiliser certaines zones d'accès facile en y dirigeant et en y maintenant des courants riches en plancton ou de réchauffer certaines régions côtières pour y acclimater de nouvelles espèces de poissons.

Par ailleurs, il ne devrait plus être insurmontable à l'homme de domestiquer ces mammifères herbivores marins que sont les siréniens (lamantins et morses) pour en consommer la chair.

Dans de telles hypothèses, on conçoit aisément qu'il faudra être en mesure de prévoir à plus ou moins long terme l'évolution des ressources océaniques en fonction du climat, des vents et des courants marins. Aussi les données recueillies par des navires-enquêteurs ou des « maisons sous la mer » devront-elles être dirigées vers des centres d'information équipés d'ordinateurs afin d'organiser à bon escient les campagnes de pêches ou de récoltes d'algues.

Mais une exploitation intensive des ressources de la mer devra nécessairement être assortie d'accords de coopération internationale et de réglementations de protection. De

tous temps, on s'est efforcé de préserver jalousement la liberté des mers, mais il faut renouveler la teneur des accords internationaux pour garantir les droits d'exploitation de la mer, droits qui sous-entendent la responsabilité d'assurer le maintien des équilibres naturels et la protection contre la pollution (1).

Or, avec les réglementations actuellement en vigueur, on court le risque de voir ces ressources gaspillées par des rivalités économiques ou politiques. La supériorité technologique des pays industrialisés en fera les principaux bénéficiaires de l'exploitation des océans qui, en principe du moins, appartiennent à tous.

C'est pourquoi, l'Institut du Droit de la Mer de l'Université de Rhode Island a consacré une grande partie de sa conférence d'été (1966) au contrôle international de l'exploitation des ressources de l'océan et dans un récent discours, le Président Johnson a déclaré :

« En aucun cas, il ne faudrait aboutir à une compétition coloniale d'un nouveau genre.
« Il faut chercher à éviter la course aux territoires sous-marins et s'assurer que les profon-
« deurs des océans sont et demeurent la propriété de tous les hommes. »

Conscients de ce problème, les Professeurs Rich (Etats-Unis) et Engelgardt (U.R.S.S.) ont proposé de considérer les ressources de l'océan, et plus particulièrement les ressources minières comme un bien commun à tous les peuples de la terre, et que les bénéfices retirés de leur exploitation soient spécifiquement affectés à l'assistance aux pays en voie de développement. La vitalité économique et la technologie des pays industrialisés contribueraient ainsi directement au progrès des pays défavorisés (XVII[e] Conférence de Pugwash, Ronneby, 3-8 septembre 1967 ; cf. ci-dessous Texte IV).

TEXTE N° II

V[e] Congrès international de Cybernétique.
Namur 11-16 septembre 1967.
Compte rendu établi pour le C.T.N. par Georges et Jeannine GUÉRON.

De ce V[e] Congrès dont la séance académique de clôture devait être solennellement marquée par la présence du roi des Belges, on peut dégager trois notions générales :

— la première est l'importance donnée aux « systèmes » par rapport à celle accordée aux « appareils ». Dès qu'on est en présence de cybernéticiens, on se convainc que les

(1) Déjà les biologistes estiment dépassé pour certaines pêches le taux de « surpêche » au delà duquel les poissons jeunes sont moins nombreux que ceux qui sont capturés ou détruits par des prédateurs (*Edmagramme*, 30 août 1967, C.T.N. n° 13.829).

« relations » ont toujours le rôle essentiel. Une machine à enseigner ne commence à être valable que si elle s'insère dans un « système élève-machine » où elle se règle sur l'élève. Tout ce qui « traite de l'information », tout ce qui est cybernétique décrit des comportements réciproques (ou agit sur eux) dans la mesure où la chose, l'être, l'organisme étudié est envisagé dans un environnement avec lequel il échange des informations qui ne cessent de les transformer l'un par l'autre ;

— la seconde porte sur « l'intelligence artificielle ». Après une période où les cybernéticiens s'efforçaient de se persuader eux-mêmes et de persuader les autres que l'on pouvait construire d'autres machines que les ordinateurs (sans intelligence) suivant des mécanismes qui se rapprocheraient davantage de ceux de la pensée humaine (pour autant qu'on soupçonne ce que sont ces derniers), ils ont maintenant tendance à dire qu'une intelligence « artificielle » peut (si elle ne doit) être différente de l'intelligence humaine. On voit tout de suite comment ce thème pourrait donner lieu à des discussions sans fin sur des sujets où tous les mots seraient à définir. Mais, à Namur, on rencontre des personnes qui s'efforcent de construire de telles machines, qui obtiennent des résultats assez saisissants, même s'ils ne sont encore que très sommaires et qui parlent donc d'expériences réelles et de travaux sérieux. Ils donnent matière à beaucoup réfléchir ;

— la troisième est que les cybernéticiens prennent conscience de travailler dans un monde nouveau. Ils traitent en effet de systèmes (souvent ouverts et non pas clos) où l'information joue le rôle essentiel. La matière et l'énergie mises en jeu dans ces systèmes sont absolument infimes. Or l'information ne se consomme, ne se conserve, ne se transmet, ne se dégrade ni comme la matière ni comme l'énergie. A la limite, dans l'univers des cybernéticiens, les principes fondamentaux de la physique (élaborés pour des systèmes clos où n'interviennent que de la matière et de l'énergie), c'est-à-dire les principes de conservation, seraient mis en doute. Personne encore ne l'écrit. Certains le disent avec d'infinies précautions. Mais la familiarité obtenue avec la notion d'information conduit à aborder — parfois — les problèmes du temps sans les certitudes des physiciens et des mathématiciens.

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Le nombre des participants — un peu plus de deux cents — et celui des communications — une centaine — étaient sensiblement les mêmes qu'aux congrès précédents. Mais l'évolution est marquée vers un nombre croissant d'organismes ou de départements de recherches publics ou privés qui se veulent cybernétiques : alors qu'en 1958, seul M. Stafford Beer pouvait se présenter au nom d'un département de Cybernétique (United Steel Company, Sheffield, Grande-Bretagne) on ne comptait pas moins de treize Instituts ou Laboratoires cybernétiques ayant délégué une ou plusieurs personnes au V^{e} Congrès.

Par ailleurs, la participation des pays de l'Est est de plus en plus importante. Cette année, près du tiers des participants et la moitié environ des communications, et non des moindres, émanent d'Allemagne de l'Est, de Pologne, de Roumanie, de Tchécoslovaquie, d'U.R.S.S., de Yougoslavie. La délégation roumaine, en particulier, a laissé une profonde impression à la fois par la solidité des travaux présentés et par la qualité de ses membres, dont la plupart allient à une compétence indéniable, une culture remarquable qu'une parfaite connaissance du français faisait apprécier à sa juste valeur.

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Quant aux communications elles-mêmes, on a pu constater d'une part que les aspects techniques qui représentaient presque l'essentiel des premiers congrès, se réduisaient à quelques exposés où le concept d'automation ne se réfère plus à une recherche scientifique mais à une étude purement technique.

D'autre part, il y a seulement dix ans, la plupart des psychosociologues et bon nombre d'économistes d'une part, les scientifiques d'autre part affectaient un certain snobisme vis-à-vis les uns des autres et s'ignoraient mutuellement. Aujourd'hui, au contraire, les « behavioristes » recherchent le contact des scientifiques et les mathématiciens s'efforcent de ne plus ignorer les problèmes humains. Ni les uns ni les autres ne se contentent plus des méthodes de travail ou des recherches classiques, espèrent trouver et trouvent souvent, en fait, dans la méthode cybernétique un outil précieux pour donner une dimension nouvelle à leurs études. Des voies prometteuses s'ouvrent pour mieux comprendre non seulement les processus de mémorisation, de reconnaissance des formes, d'apprentissage, mais aussi l'évolution de certaines maladies ou le comportement des groupes et des sociétés, mettant ainsi l'homme en mesure d'agir sur eux.

Aussi voit-on deux tendances se confirmer : d'une part on s'efforce de concevoir ou de construire des machines qui simulent ces fonctions ; d'autre part on cherche à appliquer les schémas désormais classiques des systèmes à boucles et à rétroactions à un grand nombre d'activités humaines.

Ainsi M. Gordon Pask, directeur de System Research Ltd, applique ces notions à la conception de machines à apprentissage ou à perfectionnement. Lorsqu'un homme s'entraîne ou se perfectionne, bien plus qu'à une mise en mémoire de faits et d'associations, il procède à des opérations de vérification et de comparaison. Il s'exerce à agir sur son environnement pour collecter les informations lui permettant de réaliser les « sous-objectifs » ou étapes qui le conduiront vers le but qui lui a été assigné. Le rôle du maître ou de l'instructeur, homme ou machine, consiste à poser de nouveaux problèmes à mesure que l'élève avance dans la connaissance et à « renforcer » ses projets... Lorsqu'on utilise une machine adaptative, la relation homme-machine devient alors comparable à une « conversation », limitée il est vrai au niveau de l'excitation et de la réponse à cette excitation, mais qui peut aboutir à un « métasystème » où la machine est elle-même conditionnée par le comportement de l'élève, soit qu'elle sollicite des performances de plus en plus brillantes, soit qu'elle recherche, au contraire, un point de départ facile, comportant un pourcentage de succès encourageant.

De même les machines à mémoires associatives du Docteur Sauvan, dont il a déjà été fait mention dans le *Bulletin C.T.N.* (cf. n° 37, mai-juin 1966, Texte II) pourraient être utilisées pour résoudre des problèmes complexes d'ordonnancement qui doivent tenir compte de contraintes inhérentes aux opérations matérielles, à la charge des machines, à la disponibilité et au comportement des ouvriers ou des équipes.

La plupart des communications présentées au cours de la V^{e} section consacrée à la Cybernétique et la Vie et dont les travaux se sont poursuivis pendant toute la durée du Congrès, portaient sur l'étude de systèmes simulant le comportement biologique, physiologique ou psychologique. Il serait difficile de résumer en quelques lignes la richesse des idées développées et discutées au cours de ces journées où l'on s'est beaucoup interrogé sur la perception auditive et visuelle et le « pattern recognition », où l'on a cherché à définir les processus de la réflexion et de l'émotion, où l'on a présenté des modèles du fonctionnement

des cellules et des centres nerveux, où l'on a suggéré des hypothèses pour expliquer l'évolution de certaines maladies. Ce dernier aspect devait être d'ailleurs particulièrement développé par le Docteur Masturzo, Professeur à l'Université de Naples et Directeur du Centre international de Rhumatocybernétique, au cours de la séance académique de clôture, dans une conférence intitulée « Cybernétique et Médecine ».

Mais les méthodes cybernétiques semblent désormais trouver leurs applications les plus fructueuses dans l'étude des comportements des groupes économiques et sociaux. Il ne s'agit plus tant d'étudier les structures de l'emploi ou l'impact de l'automation sur le marché du travail que d'établir des modèles de systèmes économiques, administratifs ou juridiques complexes et de déterminer sur quelles variables agir pour en optimiser le comportement.

Ces notions sont d'ailleurs également applicables à l'étude psychosociologique de groupes restreints. C'est ainsi que le Colonel Chandessais, Directeur du Centre d'études psychosociologiques des sinistres et de leur prévention (Paris), a établi un modèle cybernétique de la panique. Si l'on peut prévoir le comportement des individus et du groupe en cas de catastrophe, il est bien évident que l'on peut en déduire sur quels paramètres on pourra agir pour en minimiser les dommages ou pour les prévenir. Or, dans ce cas particulier où l'expérimentation est impossible, la méthode des modèles et l'approche cybernétique du problème semblent bien être les seules valables.

L'économie apparaît comme l'un des systèmes les plus complexes. Il est donc particulièrement intéressant d'en étudier l'évolution à l'aide des méthodes cybernétiques. Le problème ne pouvait manquer d'attirer l'attention d'économistes, de mathématiciens ou de responsables de la planification. Ainsi Mme Stojanovic, Professeur de Sciences économiques à l'Université de Belgrade, étudie l'impact des progrès techniques qui se manifestent à des époques et avec des intensités variables sur la dynamique de l'économie. L'équilibre économique est alors considéré comme un relais, un état momentané autour duquel le progrès technique fait osciller le mouvement. L'optimisation du système doit prendre en considération l'ensemble de ce mouvement pendulaire (par ex. le temps qui s'écoule entre l'accumulation et la consommation) tout en tenant compte de l'environnement dans lequel il s'inscrit.

De même M. Nicolau, Directeur du Centre de Calcul économique et de Cybernétique économique de Bucarest, a établi les équations décrivant les relations entre la production, la recherche et la formation et indique une stratégie pour optimiser le développement. C'est d'ailleurs en partant des notions cybernétiques fondamentales de feedback et de modèles qui permettent à l'homme de formuler de plus en plus finement l'évolution des phénomènes économiques, que le Professeur Manea Manescu, membre correspondant de l'Académie de la République socialiste de Roumanie, définit la « planométrie ». Cette discipline qui mesure et analyse les phénomènes économiques, permet d'élaborer les modèles structurels et prévisionnels d'une planification économique et, complétée par l'information, constitue l'un des fondements de la science de l'organisation (management).

Ainsi voit-on les conceptions économiques des pays socialistes rejoindre dans une certaine mesure des notions familières aux pays capitalistes. Mais l'approche en est différente. Il ne s'agit plus de « partir du profit » ou des situations particulières pour retrouver une concordance avec le bien commun, mais de partir d'une conception générale du fonctionnement d'une économie nationale pour décrire les situations particulières et les mécanismes (dont le profit) qui se rapprochent le plus des objectifs généraux que l'on s'est fixés. Il semble que la formulation mathématique employée pour y parvenir soit très perfectionnée dans les instituts de recherche des pays socialistes.

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Cette note ne prétend pas présenter un compte rendu intégral d'un Congrès très nourri de communications fort diverses. Elle voudrait surtout souligner l'importance des réflexions générales qui y sont présentées et l'orientation des recherches vers des séries d'application (machines « intelligentes », machines à enseigner, schémas économiques, approches nouvelles de la biologie et de la médecine) qui peuvent avoir, à l'avenir, une influence profonde sur l'évolution de l'humanité.

TEXTE N° III

Allocution du Professeur Rabi devant la Commission de l'Education.
Assemblée générale de l'American Association for the Advancement of Science (extraits).
The Physic Teacher, mai 1967.

Je crois que nous n'avons pas été assez soucieux de la signification de la science pour l'enseigner d'une façon telle que les étudiants puissent pleinement la comprendre, l'apprécier, en prendre conscience. Mises à part les applications évidentes pour tous nos contemporains, nous prêtons très peu d'attention à ses valeurs positives. En d'autres termes, nous n'avons pas su transmettre notre savoir en humanistes. Nous avons enseigné la science à tous les niveaux comme une série de « trucs » que l'élève brillant peut apprendre, dont il peut faire montre, et d'où tout au moins il peut tirer quelque joie.

Mais la science est quelque chose de très différent... C'est une aventure qui concerne toute la race humaine que d'apprendre à vivre dans l'univers qui est le nôtre et peut-être à l'aimer.

Faire partie de cet univers signifie comprendre, se comprendre soi-même, commencer à percevoir que l'homme a en lui, et bien plus qu'il ne le croyait jusqu'à présent, la capacité d'étendre à l'infini ses possibilités, et pas seulement du point de vue matériel.

C'est pourquoi (je suggère) d'enseigner la science, à quelque niveau que ce soit, d'un point de vue humaniste. Je veux dire par là qu'il faudrait l'enseigner en tenant compte d'un certain contexte historique, philosophique, social et humain pris au sens de la biographie, de la nature des hommes qui ont élaboré cette construction (scientifique) de leurs triomphes, de leurs tâtonnements, de leurs erreurs.

TEXTE N° IV

XVII^e Conférence du Mouvement de Pugwash.
Ronneby Brünn, Suède, 3-8 septembre 1967.
Compte rendu établi pour le C.T.N. par Georges et Jeannine GUÉRON.

Cette réunion, remarquablement organisée, au plan matériel, par le Comité National Suédois et considérée comme décisive par le Continuing Committee qui y proposait une réorganisation du Mouvement a été intéressante et prestigieuse, mais elle a souligné aussi les difficultés de fond auxquelles Pugwash doit faire face à l'avenir.

Elle a été intéressante du fait du nombre, de la qualité et de la diversité des participants et de la franchise avec laquelle ils ont exposé leurs points de vue. Elle a été prestigieuse notamment du fait de la participation du gouvernement suédois : le Premier ministre a passé près de 48 heures à Ronneby et Mme Myrdal, ministre du Travail a présenté une communication importante sur « Les voies du désarmement ».

Mais cette conférence a souligné les difficultés du Mouvement dont la principale paraît être la suivante : au début, les savants détenaient une connaissance privilégiée — et non partagée par les hommes politiques et les diplomates — de nombreux aspects des problèmes posés par les armements nucléaires ; à la même période, les communications entre eux étaient meilleures que celles des politiques et des diplomates. Or, cette situation exceptionnelle a pris fin. En conséquence ils sont de plus en plus portés à aborder des sujets à propos desquels leur information et leur qualification ne sont plus privilégiées et sur lesquels leurs opinions sont plus celles d'hommes de cœur et de raison (ce qui n'est pas négligeable!) que de « responsables ».

En outre, un certain nombre d'entre eux ont « vieilli » depuis 10 ans (en témoigne la mort soudaine de Sir J. Cockroft quelques jours après son élection à la place de Lord Russell — abandonnant lui-même la présidence en raison de son âge) et ils ont cristallisé certaines positions. Dès lors les réunions fournissent un écho — en lui-même très remarquable et fort bien exprimé — des oppositions d'opinion du moment, sans apporter beaucoup d'éléments imaginatifs. Un exemple de telles situations peut être donné par le peu d'attention accordé à une suggestion du Président Jules Moch à propos du traité de non-dissémination. Alors que la plupart des membres de la délégation U.S.A. et l'unanimité de la délégation d'U.R.S.S. insistaient pour une motion en sa faveur, rencontrant de nombreuses résistances, M. Jules Moch avait proposé que Pugwash se prononce pour une « signature sans condition ». Celle-ci aurait été annulée si dans un délai à fixer (2 ou 3 ans) les « grands » n'avaient pas amorcé des mesures de désarmement nucléaire. Un autre exemple est donné par l'impossibilité d'arriver à une motion commune sur le conflit du Moyen Orient.

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En ce qui concerne l'avenir du groupe et de ses activités, deux ordres de décisions les caractérisent :

• D'une part un renforcement de la structure financière et administrative. Le Continuing Committee veut avoir des ressources propres et ne plus dépendre de subventions (privées ou publiques) occasionnelles. Il veut pouvoir rémunérer un permanent de très bonne qualité. Le Professeur Rotblat n'a accepté de prolonger que pour un an ses fonctions de secrétaire général, sous condition que les comités nationaux cotisent, pendant cette année, pour un minimum (relativement modeste) de 50.000 $ (c'est ce qu'a dépensé le comité national suédois pour le congrès de Ronneby).

• D'autre part une large décentralisation. Un certain nombre de sujets doivent être pris en charge par des comités nationaux — qui organiseront, en liaison avec le Continuing Committee des « symposiums internationaux » sur ces sujets. Les réunions générales (une ou deux par an) traiteront de la coordination de ces études, de leur diffusion et de la façon dont les conclusions en seront utilisées.

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Sans reprendre ici le détail des communications, il convient de faire ressortir les points suivants les plus généralement évoqués qui avaient trait aux problèmes du désarmement, à ceux du développement ainsi qu'au rôle des hommes de science dans le monde moderne.

• Plusieurs participants ont évoqué les problèmes du contrôle des armements comme ceux des armes biologiques et chimiques. Certains ont fait remarquer que la prolifération des sous-marins nucléaires et des nations qui en possèdent ou sont en mesure d'en construire augmente les dangers d'une guerre accidentelle et devrait faire l'objet d'un accord de désarmement. Il faut d'ailleurs constater que les traités de suspension des explosions expérimentales et de non-prolifération ne sont pas des mesures de désarmement mais seulement des mesures de restriction.

Pugwash a joué un rôle essentiel en alertant le monde sur les effroyables perspectives de destruction des armes nucléaires et thermo-nucléaires. Les premières conférences réunissaient des hommes de science courageux et honnêtes qui, en s'élevant contre la suppression de l'information ont contribué à créer un climat de « responsabilité nucléaire » auprès des « grands ».

Mais depuis lors, les membres du Mouvement sont loin d'avoir progressé. Au contraire, ils reconnaissent avoir perdu de vue leur véritable objectif ou bien n'avoir pas réussi à s'entendre pour s'attaquer au seul grand problème qui se pose à l'humanité : l'apparente incapacité des hommes à vivre en paix avec d'autres hommes.

Or, le Mouvement de Pugwash pourrait s'attaquer à ce problème et devrait se fixer comme objectif essentiel de faire promouvoir dans tous les pays des recherches approfondies sur ses nombreux aspects (techniques, économiques, ergonomiques, psychosociaux). La caution de Pugwash pourrait inciter les différents organismes responsables à accorder les crédits nécessaires et la « plate-forme de bonne volonté » que représente le Mouvement de Pugwash pourrait être un bon point de départ pour ces recherches.

• A côté des problèmes du désarmement, le groupe de Pugwash est de plus en plus convaincu que le problème majeur est celui du développement du Tiers Monde. Il le situe dans la même perspective, celle d'une tension mondiale d'où peuvent résulter des conflits planétaires. Les savants se reconnaissent dès lors une responsabilité particulière car ils

pensent que la diffusion des connaissances et des techniques comme celle de l'enseignement peuvent contribuer rapidement et essentiellement à faire accéder les pays en développement au seuil du démarrage économique. Mais, peu habitués à l'action, et à l'action dans ces contrées, installés dans des positions de prestige dans leurs propres pays, ils formulent souvent des opinions fort rationnelles, mais très irréalistes, qui hérissent les représentants des nations pauvres, sensibles, eux, à la souffrance, au dénuement, au désespoir de leurs concitoyens. On assiste alors à un dialogue de sourds où ces derniers plaident l'urgence d'actions immédiates auprès des premiers qui s'agacent d'attitudes jugées passionnelles.

Les programmes d'assistance scientifique et technique posent en effet un certain nombre de problèmes généraux quels que soient le domaine, la discipline, le niveau de connaissance auxquels ils doivent se situer et quels que soient les pays où ces programmes s'exercent ou s'exerceront.

Ainsi on a cru trop longtemps que la technologie agricole valable dans les pays riches pouvait être valable pour les pays en voie de développement et qu'un transfert pur et simple des connaissances suffirait à amorcer le développement.

En réalité, au lieu de « savoir et montrer comment faire », il faut établir une coopération étroite entre spécialistes des deux mondes, travaillant et apprenant ensemble à résoudre des problèmes pour lesquels il n'y a pas encore de solutions. La recherche dans l'assistance technique doit jouer un double rôle. Il faut d'abord définir les connaissances nécessaires pour une assistance plus efficace ; dans ce cas, *les résultats* de la recherche sont importants. En second lieu, la recherche peut être considérée comme outil d'enseignement, qui dépasse les divergences culturelles, et reste neutre vis-à-vis de croyances et d'expériences antérieures. Dans ce cas, c'est *la méthode* qui est importante. Il faut donc une approche expérimentale pour apprendre et pour enseigner tout à la fois. Par exemple, on peut disposer de plusieurs méthodes pour vulgariser les techniques agronomiques : radio et TV, fermes modèles, formation de petits groupes de fermiers qui deviendront eux-mêmes des moniteurs, etc. sans que l'on sache a priori laquelle ou quelle combinaison de ces méthodes sera la plus valable pour un pays donné.

En matière de recherche fondamentale, l'une des premières conditions semble être la nécessité, pour le pays en voie de développement, de créer ou de susciter son propre « profil » scientifique. Faute de quoi un dangereux « brain-drain » s'instaure : le quart des scientifiques formés chaque année en Inde émigre définitivement vers les Etats-Unis ou l'Europe occidentale. Afin de diminuer l'ampleur du fossé, les pays qui bénéficient de cet apport de personnel qualifié pourraient ou devraient compenser cette ponction en octroyant des subventions proportionnelles au nombre d'immigrants qui permettraient d'entreprendre certains programmes de recherche, de promouvoir les échanges ou de participer plus largement à des conférences internationales.

Par ailleurs, un projet de recherches internationales peut fort bien rencontrer dans un pays en voie de développement les conditions matérielles favorables à sa mise en œuvre et faire l'objet de la création d'un « Centre d'excellence » attirant les meilleurs spécialistes étrangers, pour une année sabbatique par exemple, et permettant de former sur place le personnel qualifié. De plus, en attirant les bonnes volontés un tel centre pourrait probablement jouer un rôle comparable à celui d'un Corps des Volontaires de la Paix.

Dès le départ on pourrait adopter les méthodes techniques et scientifiques les meilleures et les plus avancées et éviter des erreurs et des tâtonnements que l'on n'a pas les

moyens de commettre et qui ont souvent coûté très cher aux pays industrialisés : la pollution, la négligence d'un inventaire précis des ressources naturelles locales, l'absence d'une planification soigneuse de l'exploitation de ces ressources sont autant d'erreurs évitables avec l'aide de ceux qui ont acquis une certaine expérience en les commettant.

• On accueille généralement avec indifférence l'idée que l'apparition récente du groupe socio-professionnel des chercheurs, la rapidité de son développement, la spécificité des sujets dont il traite (science et technique, à vocation universelle), l'impact exceptionnel de son action, dans la mesure où la science et la technique ont des conséquences générales sur les modes de vie et l'organisation des sociétés, sont autant de raison de l'étudier en lui-même et dans ses liaisons avec les autres groupes socio-professionnels. Mais l'intérêt de quelques personnalités s'éveille à cette suggestion.

Ces quelques indications se réfèrent à trois seulement des sujets traités lors de cette conférence et elles peuvent sembler plus critiques que laudatives. Il faut cependant insister sur l'utilité et la valeur du mouvement et des manifestations qu'il organise.

Pugwash constitue en effet l'une des rares occasions offertes à des personnalités de nombreuses nations de confronter leurs opinions sur des sujets *très importants*, dont elles ne sont pas des spécialistes. Si on considère les savants qui s'y retrouvent entre eux comme des « cadres du monde moderne », disposant, entre eux d'une part et auprès des gouvernements d'autre part, d'un niveau élevé de confiance justifié par leur notoriété et leur engagement humaniste, on verra dans ces réunions, bien au-delà de leur résultat immédiat, une préfiguration de l'éveil à une conscience « mondiale » de problèmes « mondiaux ». On y verra aussi une tentative — infiniment précieuse pour le C.T.N. et le C.R.M. — de relier concrètement les conséquences générales des grandes techniques nouvelles à l'évolution du Tiers Monde. Notre conviction que le destin de l'humanité la conduit à aborder — avec tous les moyens de la science et de la technique et dans une vue d'ensemble — les problèmes de la paix, de la démographie, d'une sagesse accordée à sa capacité de dominer la nature, en sort considérablement renforcée.

Et cela représente une contribution très positive à notre réflexion.

TEXTE N° V

Espérer 1999 *(analyse).*
Arthur WASKOW, Institut de Recherches politiques, Washington.
Conférence de Reeds College, mars 1967.

Le genre de connaissances qui permet d'extrapoler vers l'avenir, d'imaginer et de comprendre les effets sociaux que pourra entraîner dans vingt ans une décision prise aujourd'hui, restera longtemps l'apanage d'un très petit nombre qui risque de s'ériger en véritable technocratie. De celle-ci et des décisions qu'elle va prendre dépendra le sort des prochaines générations.

Ainsi ce qu'on décidera d'entreprendre aujourd'hui à propos des systèmes d'armements et de défense déterminera si dans vingt ans il sera encore seulement *possible* de songer à un monde désarmé. A l'exception de quelques initiés, très peu de gens le savent, ou même le soupçonnent. Et le risque est considérable de voir se développer des technologies aux implications lointaines dramatiques et n'en prendre conscience que lorsqu'il sera trop tard. Ainsi, il est d'abord indispensable d'informer le public si l'on veut préserver la société démocratique dans le monde technologique.

Dans cette perspective, il convient d'étudier et d'envisager ce qui est sérieusement *possible* et non pas ce qui n'est que vraisemblable. Au lieu de prédiction, mieux vaudrait employer le terme de « *possidiction* » : quelle politique adopter pour « permettre à certains « germes de changement, qui sont déjà perceptibles, de s'épanouir et de se développer. La « possidiction décrit des situations qui sont vraisemblables à 30 % par opposition à celles « qui ne le seraient qu'à 1 % ou au contraire à 60 %. De telles situations ont des chances « d'être réalisables mais il faut faire en sorte qu'elles le soient. Et la possidiction incite à « agir. Dans cette perspective, il faut prendre en considération deux questions essentielles. « Quelles sont les tendances majeures d'un passé récent qui sont susceptibles d'engendrer « des changements majeurs? Quels sont les groupes, au sein de la société, qui désirent « orienter ces tendances, et qui sont donc prêts à lutter pour atteindre leurs objectifs ? »

Il semble que l'on puisse identifier trois tendances majeures qui risquent d'affecter considérablement le monde de 1999 :

— L'objectif traditionnel de la guerre, obtenir la victoire par les armes, est devenu impossible à réaliser. Aussi voit-on se dessiner les ébauches d'une stratégie du désarmement dont le lancement des satellites soviétiques et l'organisation des Volontaires de la Paix sont une préfiguration.

— Une nouvelle classe émerge, du moins dans la société américaine : celle des gens qui, ayant reçu un certain degré de formation et d'éducation, capitalisent leur savoir et pensent accéder à de nouvelles libertés (comme, par exemple celle de vivre dans n'importe quel pays). Ceux-là deviennent de véritables « transnationaux » et sont beaucoup plus mobiles à la fois dans la société et dans le monde.

— Pour la première fois, ceux qui appartiennent à la « sous-classe » pour reprendre un terme de Gunnar Myrdal, prennent conscience de leur pauvreté et surtout, du fait des bouleversements technologiques, de leur impossibilité à s'élever dans l'échelle sociale. Les pauvres sont devenus conscients de leur pauvreté. Aussi ne voyons-nous plus des révoltes sporadiques mais des révolutions animées par Gandhi, Mao Tsé-toung ou Martin Luther King qui tendent à engendrer une « véritable technologie sociale de la rébellion ».

On ne sait pas si elle est valable ou réalisable, mais il est clair que la « possibilité existe ».

Ces trois tendances vont évoluer, réagir les unes sur les autres, et contribuer à forger le monde de 1999.

On pourrait avoir réalisé un véritable désarmement garanti par une institution internationale qui serait habilitée à prévenir ou à contrôler tout réarmement. Une organisation « *transnationale* » serait chargée de régler les problèmes non pas entre nations mais entre

groupes homologues ressortissant de nations différentes; elle serait comparable au B.I.T. ou à des organisations internationales d'étudiants. De même que le Concile mondial des Eglises et l'Eglise Catholique réussissent à faire pression sur certaines politiques, un tel « Forum mondial » pourrait paralyser les tentatives de réarmement postérieures à 1999. Car son action ne reposerait que sur un seul accord : la violence est interdite pour le règlement des problèmes internationaux mais tout autre moyen est autorisé.

Des « forces pacifiques » comme la course vers l'espace ou le Corps des Volontaires de la Paix sont de bons exemples de ces arguments non violents ; on peut imaginer de la même manière des Corps d'instituteurs ou d'agriculteurs qui se consacreraient non pas à la guerre mais à la lutte contre la faim.

En fin de compte il faut élaborer une possibilité de comprendre l'avenir. Si, au départ, une telle entreprise peut apparaître comme un assemblage d'actions désordonnées, il convient de ne pas perdre de vue l'objectif essentiel qui est de dresser une liste des futurs possibles et de les soumettre au jugement du public. Pour ce faire on ne peut se contenter d'utopies. Mais nombre de projets ou d'études cherchent honnêtement à extrapoler les tendances actuelles. Il faut maintenant s'efforcer de présenter ces perspectives de manière à permettre aux hommes d'exercer leur action et leurs critiques, de façon à ne pas les mettre trop tard devant des faits accomplis.

Ainsi pourrait-on imaginer des « simulations » de l'avenir où l'on analyserait les situations données en fonction des « possidictions ».

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Le Centre d'étude des conséquences générales des grandes Techniques Nouvelles (C.T.N.) et le Centre de Réflexion sur le Monde non occidental (C.R.M.), ont leur vie propre mais sont unis dans le cadre de la Fédération pour le Respect de l'Homme et de l'humanité (F.R.H.).

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Dépôt légal — 4e trimestre 1967 - N° 1535

C. T. N.

BULLETIN D'ADHÉSION

Le Soussigné .....

demeurant à .....

.....

ayant pris connaissance des statuts du C.T.N. désire adhérer au Centre d'Etude des conséquences générales des grandes Techniques Nouvelles suivant la formule ci-après (rayer les mentions inutiles).

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IMPRIMERIE ADMINISTRATIVE CENTRALE
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25TH ANNIVERSARY OBSERVANCE
OF FIRST NUCLEAR CHAIN REACTION
December 1 and 2, 1967
The University of Chicago

PRELIMINARY PROGRAM

FRIDAY, December 1

8:45 a.m. REGISTRATION.
Breasted Hall, 1155 East 58th Street

9:15 a.m. Opening Remarks, GEORGE W. BEADLE

9:30 a.m. RETROSPECTIVE SESSION
Breasted Hall, 1155 East 58th Street

Chairman: H. DeW. SMYTH
Speakers:
HERBERT ANDERSON, 9:30 a.m.
WALTER ZINN, 10:00 a.m.
EUGENE WIGNER, 11:00 a.m.
CRAWFORD GREENEWALT, 11:40 a.m. (Stanford Dupont

10:40 a.m.
Coffee Break

12:45 p.m. LUNCHEON
The Quadrangle Club, 1157 East 57th Street

2:00 p.m. APPLICATIONS OF ATOMIC ENERGY SESSION
Breasted Hall, 1155 East 58th Street

Chairman: ALBERT V. CREWE
Speakers:
WILLARD F. LIBBY, Atomic Chemistry, 2:20 p.m.
MELVIN CALVIN, New Keys to Life Processes, 3 p.
ALVIN WEINBERG, The Age of Nuclear Power, 3:40

6:30 p.m. DINNER
Center for Continuing Education, 1307 E. 60th Stre

Speaker: EMILIO SEGRE

SATURDAY, December 2

9:30 a.m. PROSPECTIVE SESSION
Breasted Hall, 1155 East 58th Street

Chairman: GLENN SEABORG
Speakers:
W. B. LEWIS, Prospect for Heavy Water Reactors, 9:30 a.m.
FRANCIS PERRIN, Atomic Energy for Power Production in France, 10:00 a.m.
A. A. SIGVARD EKLUND, The International Atom, 11:40 a.m.

10:40 a.m.
Coffee Break

12:45 p.m. LUNCHEON
The Quadrangle Club, 1157 East 57th Street
Speaker: ALBERT WOHLSTETTER, on A Perspective on the Implications of Atomic Energy.

SATURDAY AFTERNOON, December 2

3:00 p.m.	Unveiling Ceremonies for NUCLEAR ENERGY, a sculpture by Henry Moore, commissioned specially in observance of the 25th Anniversary of the first nuclear chain reaction. Ceremony at 5635 South Ellis Avenue
4:00 p.m.	Photo exhibition of the evolution of the sculpture, NUCLEAR ENERGY. High Energy Physics Building, 933 East 56th Street.
5:30 p.m.	Reception at the Reynolds Club, 5706 South University Avenue (adjacent to Hutchinson Commons).
6:30 p.m.	Dinner in Hutchinson Commons, 5706 South University Avenue.
8:30 p.m.	Motion Picture Documentary on the Chicago Pile, Mandel Hall, adjacent to Hutchinson Commons, 5706 South University Avenue.

* * * * * *

Mr. and Mrs. Herbert Lawrence Anderson

Cocktails and Buffet Supper
Thursday, November 30, 7:30 PM
4923 South Kimbark Avenue,
- If you arrive in time
- please do come We would like
To see you.

THE UNIVERSITY OF CHICAGO
CHICAGO · ILLINOIS 60637

THE ENRICO FERMI INSTITUTE
FOR NUCLEAR STUDIES
5630 ELLIS AVENUE

Ret'd card
10-24-67
"prob. not"

Dear Colleague:

On December 1 and 2, 1967, The University of Chicago will observe the 25th Anniversary of the First Nuclear Chain Reaction.

I am writing you now, in anticipation of the formal invitation you will receive later, to urge that you set aside these dates. The 25th Anniversary observance will be an occasion for the reunion of persons who were associated with the original experiment. A number of talks have been arranged to recall the early days and to outline some of the progress that has been made since. A specially commissioned work of sculpture by Henry Moore will be unveiled at the site of the original experiment.

A preliminary program for the two-day event is attached. You will receive a formal invitation in due course. I hope very much that you will be able to share with us the events of this important commemorative occasion. Please let me know whether you will be able to come. A reply card is enclosed for your convenience.

Sincerely,

Herbert L. Anderson
Professor of Physics

25TH ANNIVERSARY OBSERVANCE
OF FIRST NUCLEAR CHAIN REACTION

DECEMBER 1 AND 2, 1967
THE UNIVERSITY OF CHICAGO

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A. SIGVARD EKLUND, title to be announced, 11:40 a.m.

10:40 a.m. Coffee break

12:45 p.m. — LUNCHEON - Speaker, ALBERT WOHLSTETTER, A Perspective on the Implications of Atomic Energy

3:00 p.m. — DEDICATION OF HENRY MOORE SCULPTURE

4:00 p.m. — EXHIBITION OF THE WORKS OF HENRY MOORE

5:30 p.m. — RECEPTION

6:30 p.m. — DINNER

8:30 p.m. — MOTION PICTURE DOCUMENTARY ON THE CHICAGO PILE

* * * *

The Atomic Energy Commission

and

The Smithsonian Institution

request the pleasure of the company of

Dr. Gertrud Weiss-Szilard

on Wednesday, November 29, 1967

from 5:30 p.m. to 7:00 p.m.

in the

Museum of History and Technology

Constitution Avenue at 14th Street, NW.

in the honor of Enrico Fermi

and

the 25th anniversary of the

first controlled nuclear chain reaction

at Stagg Field of the

University of Chicago

December 2, 1942

R.s.v.p.

(202) 381–5543

From November 29 – December 8 there will be a special exhibition of: Memorabilia of Enrico Fermi and of the great experiment which introduced a new power resource to the world; a model of CP–1, the first nuclear reactor; and a model of the full size replica of CP–1 to be installed in the hall of nuclear energy.

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December 2, 1942

R.s.v.p.
(202) 381–5543

program

25th anniversary observance of the first nuclear chain reaction

december 1 and 2, 1967

Exhibition, CHICAGO'S HOMAGE TO HENRY MOORE, a selection of his drawings and sculpture, presented by the Renaissance Society and the Committee for the 25th Anniversary Observance of the First Nuclear Chain Reaction, may be viewed Monday through Saturday, 9:00 A.M. to 5:00 P.M., December 1 through December 22, at the School of Social Service Administration Building, 969 East 60th Street.

program

friday, december 1

8:45 am REGISTRATION
Breasted Hall, 1155 East 58th Street

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GEORGE W. BEADLE
President, The University of Chicago

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Breasted Hall, 1155 East 58th Street

Chairman:
H. DEW. SMYTH
United States Representative to International Atomic Energy Agency, Vienna, Austria; and Emeritus Professor of Physics, Princeton University

9:30 am *Speakers:*
HERBERT ANDERSON
Professor of Physics, The University of Chicago

10:00 am WALTER ZINN
Vice President, Combustion Engineering Company

10:40 am *Coffee Break*

11:00 am EUGENE WIGNER
Professor of Mathematical Physics, Princeton University; and Nobel Laureate in Physics

11:40 am CRAWFORD GREENEWALT
Chairman, E. I. duPont de Nemours Company

12:45 pm *LUNCHEON*
The Quadrangle Club, 1157 East 57th Street

2:00 pm APPLICATIONS OF ATOMIC ENERGY SESSION
Breasted Hall, 1155 East 58th Street

Chairman:
ALBERT V. CREWE
Professor of Physics, The University of Chicago

2:20 pm *Speakers:*
WILLARD F. LIBBY
Professor of Chemistry, University of California at Los Angeles; and Nobel Laureate in Chemistry.
"ATOMIC CHEMISTRY"

3:00 pm MELVIN CALVIN
Director, Bio-Organic Division of Lawrence Radiation Laboratory, University of California at Berkeley; and Nobel Laureate in Chemistry
"NEW KEYS TO LIFE PROCESSES"

3:40 pm ALVIN WEINBERG
Director, Oak Ridge National Laboratory
"THE AGE OF NUCLEAR POWER"

6:30 pm DINNER
The Center for Continuing Education
1307 East 60th Street

Speaker:
EMILIO SEGRÈ
Professor of Physics, University of California; and Nobel Laureate in Physics
"THE EARLY YEARS OF ENRICO FERMI"

saturday, december 2

8:45 am PROSPECTIVE SESSION

Breasted Hall, 1155 East 58th Street

Chairman:

GLENN SEABORG

Chairman, U.S. Atomic Energy Commission; and Nobel Laureate in Chemistry

Speakers:

W. B. LEWIS

Senior Vice President for Science, Atomic Energy of Canada, Ltd.

"PROSPECT FOR HEAVY WATER REACTORS"

FRANCIS PERRIN

Haut-Commissaire a l'Énergie Atomique, Paris

"ATOMIC ENERGY FOR POWER PRODUCTION IN FRANCE"

A. SIGVARD EKLUND

Secretary-General, International Atomic Energy Agency, Vienna, Austria

"THE INTERNATIONAL ATOM"

SPECIAL DECEMBER 2 OBSERVANCE IMMEDIATELY FOLLOWING PROSPECTIVE SESSION

Exchange of Greetings with Italian Government via Comsat Satellite. Glenn T. Seaborg presiding. Mandel Hall, 57th Street and South University Avenue.

Audience must be seated by 10:50 a.m.

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Professor of Political Science, The Univer sity of Chicago

"A PERSPECTIVE ON THE IMPLICATIONS O ATOMIC ENERGY"

3:00 pm UNVEILING CEREMONY

East side of Ellis Avenue, between 56th an 57th Streets

Unveiling of Henry Moore's "Nuclea Energy," a work of sculpture speciall commissioned to observe the 25th Anni versary of the First Nuclear Chain Reac tion.

4:00 pm PHOTO EXHIBITION

The Evolution of Henry Moore's "Nuclear Energy"

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Mandel Hall, 57th Street and South Univer sity Avenue

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FIRST NUCLEAR CHAIN REACTION

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The Planning Committee
for the 25th Anniversary Observance
of the First Nuclear Chain Reaction
wishes to acknowledge with thanks
the generous support

AEC

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

No. K-260
Tel. 973-3335 or
973-3446

November, 1967

CP-1 IN THE RACE FOR THE ATOMIC BOMB

by
Dr. Richard G. Hewlett
Chief Historian
U. S. Atomic Energy Commission

Enrico Fermi's famous experiment in Chicago on December 2, 1942, marked the end of the first lap in the desperate race against the Germans for the atomic bomb.

That race had begun early in January 1939 when the world renowned physicist, Niels Bohr, arrived in New York with some electrifying news. Two German scientists, Otto Hahn and Fritz Strassmann, had been bombarding the heavy element uranium with neutrons. They had discovered that the neutrons split the uranium atoms in two, a reaction that theoretically would release tremendous amounts of energy. Scientists the world over rushed to their laboratories to verify not only the German experiment but also the possibility that each fission might release several free neutrons, which in turn would cause additional fissions. The results suggested the possibility of starting a self-sustaining chain reaction which would produce energy for a variety of uses or perhaps a weapon of incredible power.

In the United States during 1939 the discovery had little impact outside university laboratories. American physicists explored the fission process in hundreds of experiments, but only a few men--for the most part those who had fled the tyranny of Nazi Germany--saw immediate implications for the new force on the world scene. A letter from Albert Einstein to President Roosevelt brought no action until early 1940, and even then Government support was hardly adequate for a few experiments at Columbia University.

Arguments for a cautious approach seemed obvious. A demonstration of the chain reaction would require more uranium metal than then existed in the entire western world. It seemed unlikely that the reaction would be useful as a power source without many years of development, and in 1940 the United States still seemed too far from war in Europe to justify expenditures for developing an atomic weapon. An added deterrent was the discovery by John R. Dunning and Alfred O. C. Nier and their associates that most of the fissions occurred in uranium 235, a lighter isotope of the element which constitutes less than 1 per cent of the material as found in nature. Isotope separation was a difficult process not yet employed on more than a laboratory scale. Even if it could be used to produce uranium 235, it would be fantastically expensive.

(more)

A small committee of Government officials working under Lyman J. Briggs, director of the National Bureau of Standards, concluded in the spring of 1940 that the prudent course was to finance some research on isotope separation on a very small scale and some preliminary work which Fermi and Leo Szilard proposed on the chain reaction. Their idea was to assemble blocks of graphite interspersed with lumps of uranium to form a "pile." The graphite would slow down or "moderate" the neutrons coming from the fission reaction and thereby increase the probability of their causing additional fissions in sustaining the chain reaction. If the pile contained a large amount of natural uranium metal, there would be enough uranium 235 for the fission reaction. A few experiments on isotope separation and Fermi's work with neutron reactions in graphite constituted the whole of the Government's effort in 1940.

New forces, however, were already at work before the end of 1940. As American involvement in the war became more likely, President Roosevelt had turned to Vannevar Bush and James B. Conant to marshal the nation's scientists for defense. Already interested in the uranium project, Bush revitalized the Briggs committee before the end of the year, and early in 1941 Ernest O. Lawrence, director of the Radiation Laboratory at the University of California, added his energy and enthusiasm to the efforts of those who favored increased Government support. Research by a group under Glenn T. Seaborg at Berkeley had led to the discovery of a new man-made element later named "plutonium." Like uranium 235, plutonium would fission and apparently could be made in the pile from the plentiful uranium 238 isotope. If Fermi's research proved successful, the pile might be a much better source of fissionable material than an isotope separation plant.

The one remaining obstacle to a full-scale effort on nuclear fission was the lack of evidence that it would have any practical application in the war effort. Without such an assurance, Conant and Bush did not dare risk investing already scarce resources of scientific talent and materials in nuclear research. Two studies of research progress by a special committee of the National Academy of Sciences in 1941 failed to reveal hopeful prospects. Then on July 10, 1941, Bush learned that the British were convinced an atomic bomb was feasible. They believed they could build an isotope separation plant and design an atomic weapon of reasonable size. This was the evidence Bush and Conant had been seeking. A few days before the Japanese attack on Pearl Harbor they recommended to President Roosevelt an all-out research effort on methods of producing fissionable material and the bomb.

The United States had taken more than two years to join the war against Germany, and it seemed possible the nation was that far behind the Germans in developing the atomic bomb. Time was of the essence. No one understood that better than Arthur H. Compton, the distinguished physicist whom Bush had asked to direct the plutonium project. With the odds favoring the uranium 235 approach, Compton knew he faced an awesome task. He had no laboratories, no scientists, no equipment, and no materials, but he went to work. Within a few weeks he had convinced many of the nation's leading scientists, including Fermi, to join him in a new laboratory at the University of Chicago. With help from the Office of Scientific Research and Development, he and a small group of associates began a feverish quest for the materials necessary for the chain reaction:

(more)

large quantities of incredibly pure graphite and amounts of uranium metal that staggered the imagination. He borrowed equipment and installed it in classrooms at Chicago.

While Compton struggled to create a laboratory for the chain reaction at Chicago, Fermi continued to study neutron multiplication in the small assembly of low-grade graphite and uranium oxide at Columbia. Fermi's results were encouraging but could not be conclusive. Despite heroic work to produce the necessary materials, construction of the pile under the west stands of the Chicago stadium ground to a halt in the fall of 1942 as the available stocks of graphite and uranium metal were exhausted.

The day of decision was fast approaching. Convinced that the chances for an atomic bomb were good, Bush had brought in the Army Engineers to transform laboratory experiments into operating plants. Under the hard-driving General Leslie R. Groves, the pace of the Manhattan Project was quickening every day. Groves had appointed a special committee of outstanding engineers to examine progress on each of the four methods then being considered for producing fissionable material. Unless Fermi and his team could complete the Chicago pile (later called "CP-1") before the reviewing committee arrived in late November, 1942, Compton's dream of producing plutonium for the bomb might be shattered.

In a final effort to speed completion of the pile, Fermi decided to use substandard graphite and uranium oxide for the outer regions of the assembly. Teams of scientists working around the clock slaved over the bars of slippery graphite. Even these extraordinary efforts seemed doomed to failure. When the reviewing committee arrived in Chicago on Thanksgiving Day, the pile was not yet complete. One last hope lay in the fact that the committee would again be in Chicago after visiting Lawrence's laboratory in Berkeley. Compton ordered Fermi to proceed at top speed. When the committee returned on the morning of December 2, 1942, Fermi was ready. The successful demonstration that day assured continuation of the plutonium project and kept alive the hopes that the United States would win the race for the bomb. These hopes were realized less than three years later, when the first assembly of fissionable material (plutonium) was detonated at Alamogordo, New Mexico.

#

program

25th anniversary observance of the first nuclear chain reaction

december 1 and 2, 1967

the university of chicago / chicago, illinois

program

friday, december 1

8:45 am REGISTRATION
Breasted Hall, 1155 East 58th Street

9:15 am *Opening Remarks*
GEORGE W. BEADLE
President, The University of Chicago

9:30 am RETROSPECTIVE SESSION
Breasted Hall, 1155 East 58th Street

Chairman:
H. DEW. SMYTH
United States Representative to International Atomic Energy Agency, Vienna, Austria; and Emeritus Professor of Physics, Princeton University

9:30 am *Speakers:*
HERBERT ANDERSON
Professor of Physics, The University of Chicago

10:00 am WALTER ZINN
Vice President, Combustion Engineering Company

10:40 am *Coffee Break*

11:00 am EUGENE WIGNER
Professor of Mathematical Physics, Princeton University; and Nobel Laureate in Physics

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The Evolution of Henry Moore's "Nuclear Energy"

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Mandel Hall, 57th Street and South University Avenue

Exhibition, CHICAGO'S HOMAGE TO HENRY MOORE, a selection of his drawings and sculpture, presented by the Renaissance Society and the Committee for the 25th Anniversary Observance of the First Nuclear Chain Reaction, may be viewed Monday through Saturday, 9:00 A.M. to 5:00 P.M., December 1 through December 22, at the School of Social Service Administration Building, 969 East 60th Street.

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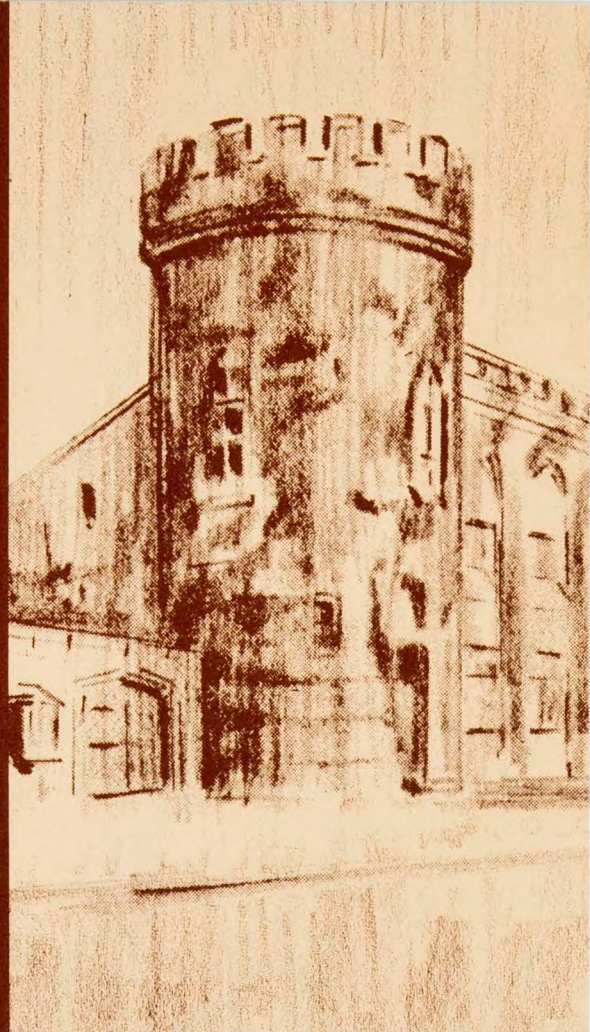
THE DAY TOMORROW BEGAN

THE STORY OF CP-1, THE FIRST ATOMIC PILE



COVER:

The West Stands of Stagg Field, The University of Chicago, site of the first nuclear reactor, Chicago Pile No. 1, (CP1).

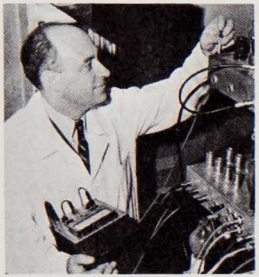
This booklet is based on the film, THE DAY TOMORROW BEGAN -- the story of the first nuclear chain reaction. It contains excerpts of interviews with the scientists themselves, as they pause to reflect on the events and the people involved in this memorable experiment.

The film and this booklet were produced by the Atomic Energy Commission's Argonne National Laboratory. The film is available for free loan from USAEC Headquarters and field libraries.

THE DAY TOMORROW BEGAN

We live in The Atomic Age. Born in wartime, the atom has grown in peace to deliver unlimited power and unforeseen tools for medicine, industry and research. No one can say just when The Atomic Age began. A long series of discoveries and experiments have made it possible . . . each a step in the progression which has brought mankind's greatest opportunities and problems.

This is the story of one memorable experiment and the scientists who were involved. The persons you see in this film, the voices you hear, are real. These are the people who opened The Atomic Age, and this is one experiment - - the story of CP-1, THE DAY TOMORROW BEGAN.



Enrico Fermi

Neils Bohr

It is December 2, 1942, The University of Chicago - - "birthplace" of The Atomic Age. Here, behind the vine-covered walls of an almost abandoned football field the government has already begun work on the most important device in modern history. Never before, and perhaps never again will a single effort so profoundly affect the future of mankind.

Here, in this unimpressive building are gathered part of the elite corps of world scientists who are building the bomb. From every part of the world they have come since 1939, to join forces with American scientists. Never has such an array of scientific talent been devoted to a single problem. For in Europe a desperate battle rages and the Third Reich threatens to overwhelm the world.

Among the first to feel the effects of the Nazi regime and understand its threat were the Jewish scientists. One by one they left Europe for Britain, Canada, and most of all the United States. With them came Italian Nobel prize winner, Enrico Fermi, whose wife was Jewish.

Fermi was an unusual person. He combined experimental skill with theoretical talent and intense personal drive. Swimming, mountain-climbing, skiing; he was always eager for a new challenge.

Only a few days after the Fermis, there arrived in New York the most famous nuclear scientist of the time, Neils Bohr - - the Father of Atomic Theory. Almost everyone in the field had studied or worked with Bohr. Together with Professor John Wheeler at Princeton University, he developed the first theory of fission and debated the possibility of making the bomb . . .

John Wheeler

Leo Szilard

James Conant

Vannevar Bush

"I particularly remember the room down the hall, where he was telling us, 'No, the bomb will not be possible. In principle, you could separate Uranium-235 and make a bomb; but in fact, to do it would take the whole energies of a complete nation.' Of course he was only too right; it took the efforts of three nations to build it." . . . John Wheeler

At Columbia University, Fermi was joined by another prominent physicist, Leo Szilard. Brilliant and volatile, Szilard was almost the antithesis of Fermi. He never lectured . . . never kept a schedule . . . a brilliant mind connected to a pair of hands that were never soiled in a laboratory.

As the atomic fraternity collected, American scientists were made keenly aware of the German threat. James Conant, President of Harvard, and Vannevar Bush, President of the Carnegie Institution, were already organizing government support for scientific research. To the theoreticians at Princeton and Columbia Universities were added the formidable talents of men like Arthur Compton, Chairman of the Physics Department at The University of Chicago, and Ernest Lawrence, Director of the University of California Radiation Laboratory and inventor of the cyclotron.

Here was an American breed of scientists, experienced in the construction of impressive hardware, conscious of world politics, and determined to enlist government support.

By the end of 1939 (two years before most Americans would become seriously involved), they had already organized a coordinated program to investigate atomic energy, and had imposed a voluntary program of secrecy . . .

"Pretty soon it was the time when they started talking of the possibility of a chain reaction. Enrico explained it to me, and shortly after that they stopped talking about it. They imposed secrecy on themselves and then I didn't hear anything more for years until the Smythe Report." Laura Fermi

Laura and Enrico Fermi

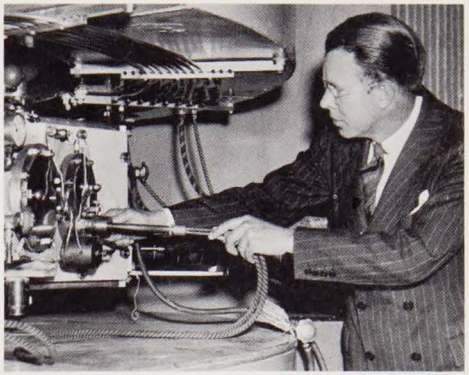
Thus began the race to unlock the power of the atom . . . to harness it . . . to build the bomb.

And just what is this phenomenon? What is atomic energy?

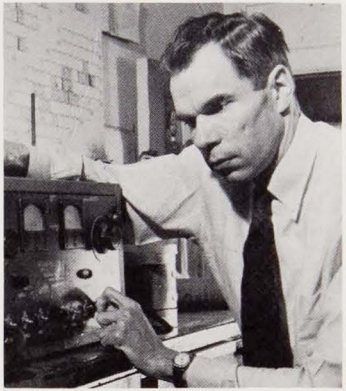
All the universe is made of atoms . . . big ones . . . little ones . . . each a cloud of electrons around a little bundle of matter called the nucleus. Every atom is built this way, but in uranium a few of the atoms are different - - they are U-235. The energy in a few pounds of U-235 is equivalent to hundreds of thousands of tons of dynamite.

If we could separate the U-235, the results would be fantastic! A bomb . . . a single bomb, powerful enough to destroy most cities . . . a bomb big enough to end the war with a single blow.

In natural uranium there is very little U-235. There is no way to make a bomb with natural uranium. But if we make a big enough block of uranium, so



Ernest O. Lawrence



Glenn Seaborg

enough U-235 will be present, it should be possible to start a chain reaction, and for the first time, release atomic energy. Convinced that this was possible, Fermi and Szilard undertook to build such a device.

In the meantime, at Berkeley, a team working under Lawrence had made a vital discovery. Using the cyclotron, future Nobel prize winner, Glenn Seaborg, produced a submicroscopic speck of an entirely new element, Plutonium. From incredibly small samples it was possible to determine that here was a new manmade element which could substitute for U-235. The discovery made the Fermi-Szilard experiment more important than ever. If successful, the chain reaction could produce plutonium in unlimited quantities.

Furthermore, U-235 was almost impossible to separate from natural uranium. But plutonium . . . plutonium could be separated chemically. Here was the ultimate material to make the bomb . . .

"The sample that was isolated as a result of bombarding these hundreds of pounds of uranium with neutrons at Berkeley and St. Louis, was finally isolated and in pure enough form to weigh a few micrograms on September 10, 1942, by special balance . . . the only balance in which a quartz fiber is suspended at one end and comes out like this, with a weighing pan hanging from that end and then the sample put on that weighing pan, depressed the quartz fiber, and the amount that the quartz fiber went down because of the weight in the weighing pan could be calibrated to correspond to the weight of the sample. And using that, the first sample of plutonium to be weighed was found to weigh 2.77 micrograms." . . .

. . . Glenn Seaborg

"This was an absolutely fantastic idea, not merely to make a bomb, but to make it out of an element that had never existed before. And the manufacture of this new element, this idea of synthesis was so preposterous that you could say, 'How is anybody mad enough to think it could be carried through?', as it was." . . . John Wheeler

So this is the problem: make a chain reaction; to make plutonium; to make a bomb; to end the war.

In Columbia, in Princeton, in Chicago, the plan is set. To make a chain reaction we must suspend lumps of uranium within a nuclear catalyst called a moderator. Heavy water would be the best moderator, but there is none in the United States.

And perhaps we are already too late. In Germany, other physicists have a year headstart. In Czechoslovakia, they acquire a major supply of uranium ore. And in Norway they acquire the world's only significant source of heavy water. The combination was ominous. While the British set out to destroy the Norwegian plant, we search desperately for a substitute.

At Columbia, Fermi and Szilard, Anderson and Zinn, make the first tentative tests of a new moderator material - - graphite. A four-inch-square bar of filthy, dirty, slippery carbon - - good for pencils; good for making arc lamps; good for oiling locks; and now good for splitting atoms.

Cut the long rods into blocks; drill them with holes; and fill the holes with uranium. Then take the bricks and build a pile. The result: a graphite cake filled with uranium raisins. Is it really this easy? Well, no.

Arthur Compton

General Leslie R. Groves

There really isn't any uranium metal to speak of. In the whole United States there is less than a couple of ounces. Not enough uranium . . . not enough graphite . . . but there is enough to assemble about an eight-foot cube, and from this we can take some measurements.

But the uranium is not good enough; the graphite is not pure enough. Over and over small piles are assembled, always testing newer and purer materials.

About this time, British scientists reached a dramatic conclusion: they estimated that as little as 20 pounds of U-235 could make a bomb. Conant and Bush were convinced. They launched an all-out effort to produce the bomb, only one day before Pearl Harbor.

Four parallel crash programs were begun. Three concentrated on techniques to separate U-235. The fourth, the Plutonium Project, was placed under the supervision of Nobel Laureate, Arthur Compton. No longer was plutonium production a laboratory experiment; now it was a military program . . .

"I met Dr. Compton at that time and of course, like everyone who met Dr. Compton, you could not help but be impressed by his enthusiasm, his earnestness, and his complete confidence in success.

I spent the morning going around the laboratory, and after considerable discussions with Dr. Compton, was impressed with the idea that they had of attacking their problem in all sorts of different directions and not arriving at a decision.

For example, they had five different methods that they were talking about for cooling the pile. Now it just wasn't practical from the management standpoint and engineering standpoint, as well as the research angle, to proceed on five different things when there wasn't any advantage to be gained from it." . . . General Leslie R. Groves

Within weeks, Compton's crash program to develop a plutonium-producing pile had committed over a million dollars. Although no one had yet achieved a chain reaction, he laid out a time-table for completion of the project: by January 1943, to achieve the first chain reaction; by January 1944, to separate the first plutonium; by January 1945, to deliver the first bomb.

It seemed certain by now that sufficiently pure materials would sustain a chain reaction. But it was not at all clear whether such materials could be produced. The most minute impurity could effectively block any reaction.

There was only a single producer of large quantities of graphite: the National Carbon Company. And in Canada, the only significant uranium mine in the Western Hemisphere was being activated to produce uranium in large quantities.

Until now, uranium had been only a scientific curiosity - - a metal powder which occasionally burst into flames spontaneously. At Iowa State University, Frank Spedding, a chemist who had worked with similar materials, developed a new technique for producing the metal. Into containers was loaded a mixture of calcium and uranium salt. When ignited, the reaction produced a heavy ingot of substantially pure uranium . . .

Frank Spedding

> *"There was a great deal of curiosity on the campus as to what we were doing, particularly as once in a while one of our retorts would blow up and with the magnesium, which is what you use in flash powder, it would light up the whole building and it gave an illusion -- this light was so bright, that the building swelled up and then sunk back. The college press office was right across the street from this building, so naturally their curiosity was very great. But nobody would talk so they didn't know what was going on."* . . . Frank Spedding

Now Compton was sure the pile would work. Rather than wait for an actual demonstration, he recommended building a plutonium plant immediately.

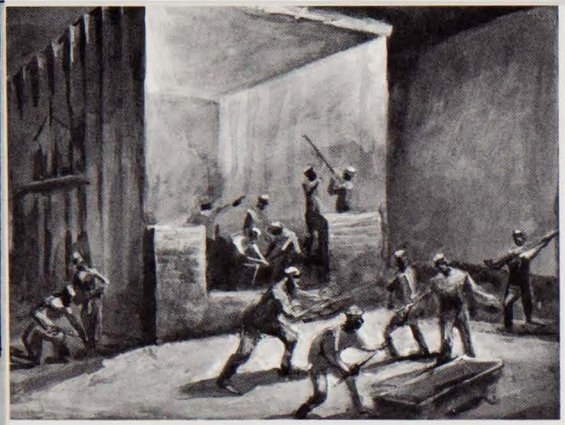
"I told Compton that the only one that I knew of that could do the job was DuPont. And I talked to the DuPont people and it was arranged; finally they agreed that they would do the job." . . General Leslie R. Groves

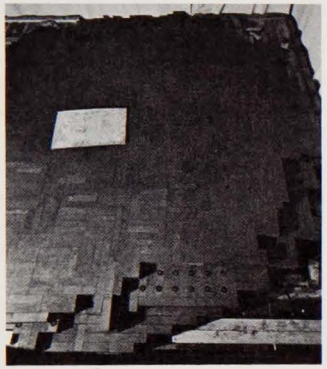
Crawford Greenewalt

"Well, I must say that this whole field was so new to us and so strange that we weren't sure whether these people were crazy or whether they weren't. It was completely unprecedented. The only thing we felt we could add to it actually, was our knowledge and experience in designing and operating plants of great substance and great magnitude. So that we had been impressed with the enormous importance of this venture in terms of winning the war.

Furthermore, we recognized this was a potential engine of great destructive power and we didn't want to make any money out of it. So we decided as a matter of patriotism, if you want to use that somewhat hackneyed word, that we should devote our talents to the service of our government at a critical time; we should devote our talents without trying to earn a fee, small or substantial, out of it." . . . Crawford Greenewalt

November . . . and the pile begins. Not another "test" this time, but a full-scale attempt to start a chain reaction. This will be the 31st pile . . . bigger . . . and with better materials. If the new pile is big enough, it ought to "go."

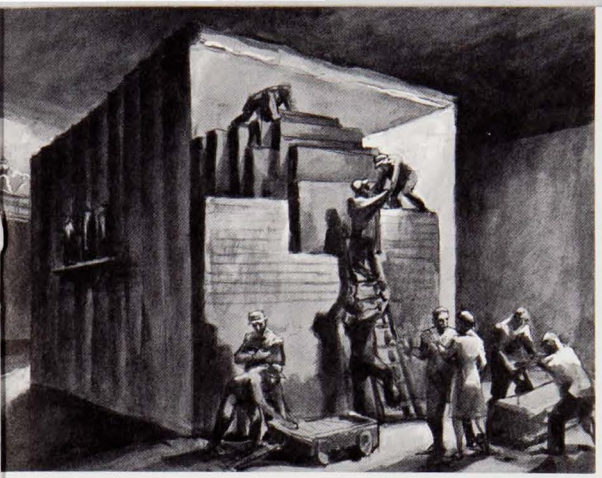




But because there is so little material, so variable in quality, we must be miserly . . . make every bit of uranium count. No rectangular pile this time . . . we need the most efficient pattern for our small supply of material: round. In the middle where it will do the most good, we will put the uranium metal. Around this, we will put the "weaker" uranium oxide. . . . always with the best material toward the center and poorer toward the outside.

And of course as always, the material must be formed in lumps, and between these, the graphite moderator. Under and around the graphite is wood . . . to carry the load and fill in the corners of the big block. And what if there isn't quite enough material . . . or what if the material isn't quite good enough . . . then what? We can do one last thing: we can take out the air between the bricks. So "just in case," we order from Goodyear a square balloon, just the right size to fit around the pile of carbon blocks. And if we must, we'll pump out the air!

As fast as material arrives it is sawed and planed, drilled and turned and pressed . . . and stacked in the ever-growing pile. Here are actual photographs taken as the pile progressed. Layer on layer of graphite bricks . . . and uranium eggs. But size is not enough. Because if it works, this pile, Chicago Pile Number One, will need to be controlled . . . here's how.



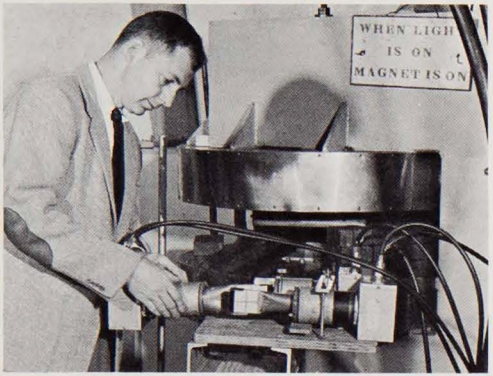
Walter Zinn

Into the pile we will add rods of cadmium which soak up neutrons. As long as these rods are in the pile, there can be no reaction. But pull them out . . . push them in . . . these are the control rods which will turn it on . . . and turn it off.

There are three sets: first, a set of motor-driven rods, controlled from the balcony. These will be used for a coarse control of the reaction. Second, one additional rod for fine control. This will be pulled out by hand. Last, running right through the center of the pile is an emergency rod. In case of trouble, this emergency rod will be pulled into the pile by a rope attached to a heavy weight.

Day by day the pile grows higher. Week after week the crews work at making the graphite bricks, and pressing the lumps of uranium oxide. This is not a little experiment . . . 400 tons of graphite! 50 tons of uranium! 40,000 bricks to be sawed and planed and drilled and stacked! 22,000 uranium slugs to press and place!

"Graphite was being received from several manufacturers. And this material, when it arrived, was in rather an unusable form. Because as it was made, it had surface roughness and actually a little distortion in the bars of graphite, which didn't permit its direct use. So these bars had to be machined, and we set up a machining facility. The word facility is a little bit grand for what we had; we simply put some machines and some ventilation into a room in the squash court and proceeded to square up the bars and cut them to the right lengths." . . . Walter Zinn



Herbert Anderson

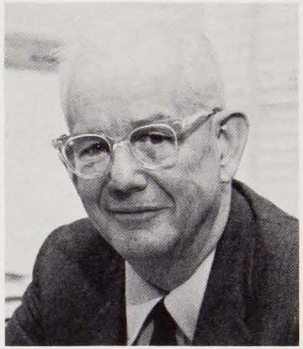
Leona Libby

"My objective was always to equal or better the performance of Zinn during the day, so my group always put on the same number, or one more layer and then we went home. So it wasn't really a twenty-four-hour shift, but it was more like sixteen or eighteen hours, or something like that." . . . Herbert Anderson

"Now Wally Zinn wouldn't let me work at the squash court because, you see, everybody wore overalls and goggles and a mask against the dust. So everybody looked alike. And a miner's cap -- you know, a regular striped blue-ticking workman's cap. So everyone looked alike. And he said in case he had to say nasty words to somebody, he didn't want it to be a girl. So I was excluded from the actual construction, although I was in and out every day with calibrations and measuring the growing neutron flux of the reactor as it added layer by layer.

It was a very hard-driving operation. There were milling machines to drill the graphite blocks. There were people cutting the graphite, carrying it, stacking it, drilling it; and of course, there was graphite dust everywhere . . . everything was black." . . . Leona Libby

"I remember one night when we were pushing these things . . . we used just ordinary woodworking tools, you see . . . and we were pushing these through the . . . through the planer, and here was Enrico Fermi, stripped to the waist, pushing these graphite blocks through the shaper, just glistening absolutely black, clear to his waist. Well, just throwing graphite dust in every direction. He could have had a part in Othello that would have made him internationally recognized as one of the artistes of all time. Just . . . if one could have had a colored photograph, it would have been worth many fortunes." . . . Norman Hilberry



Norman Hilberry

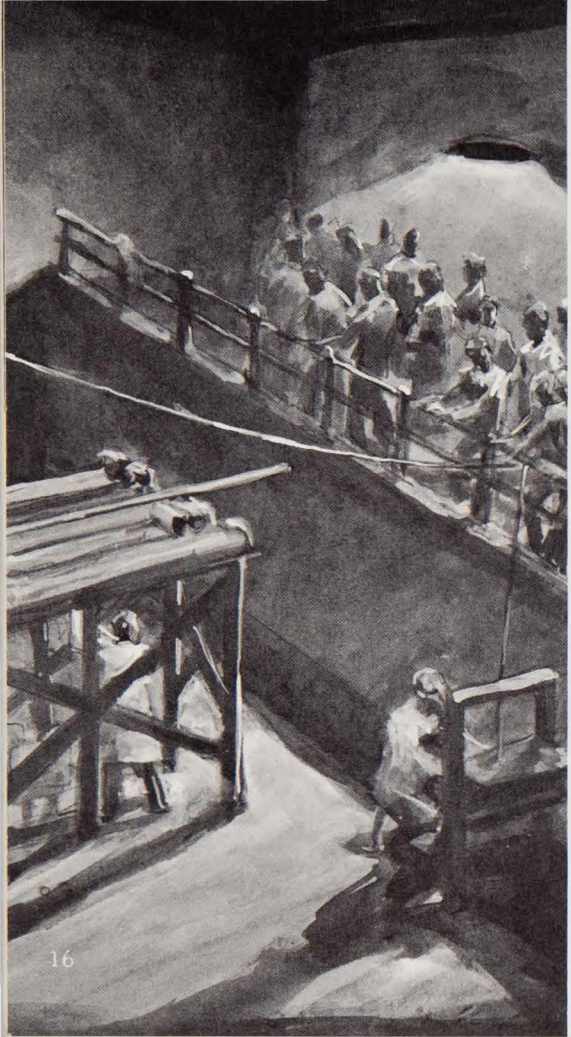
December 2, a cold winter day, and under the stands the steam lines have quit working. In the beastly cold with the snow creaking underfoot, the scientists gather. And now the test begins.

The first control rods are pulled out, and the emergency rod is tied in place. Step by step . . . inch by inch . . . Fermi calls for the control rod to be withdrawn. Bit by bit the rod is pulled, and each time the intensity rises. Each time Fermi predicts the level where the rise will stop . . . closer and closer to the point where it will not stop. By the rail, Norm Hilberry stands ready with a hatchet to cut the line holding the emergency rod . . .

> *"Quite frankly, it never occurred to me that the axe would really have to be swung, any more than I am sure it ever occurred to Al Graves and Company that they would ever throw these damn bottles down because they saw some glow . . .* Norman Hilberry

Above the pile, just in case, are bottles of cadmium-salt solution, ready to flood the pile and stop the reaction in case of trouble . . .

> *"And the last words Fermi said to him were, 'Now this is the final emergency. If the thing gets away from us, you're to break this. But I want you to watch me, and if I drop dead, then you're to break it. If I'm alive, I'll use the sledge-hammer on you."* . . . Frank Spedding

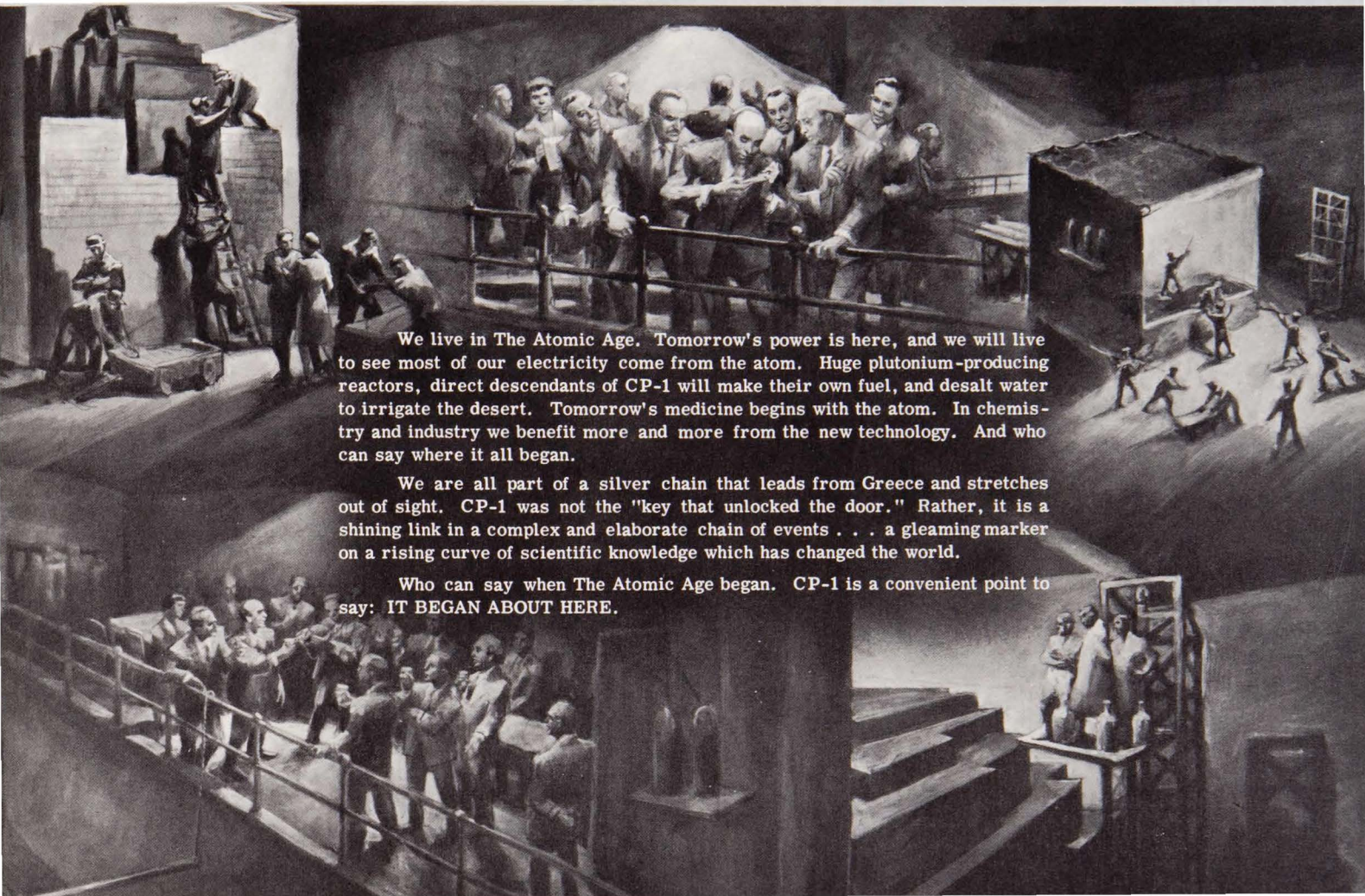


Now, one last pull and the rise will not stop. The counters will continue to rise until we choose to turn it off . . .

"And at a certain point the safety controls which had been set to a certain maximum flux began to give a bell signal. But people wanted it still to go a little higher, so they simply pulled the wires off the bell signal so it didn't ring, and went a little higher.

And then Enrico said: 'Put the control rods in.' But it was quite clear it was the answer to everyone's hopes and dreams. I don't know, but there was absolutely dead silence. Nobody said anything. Then somewhat later, after the control rods were all put to bed and the charts were pulled out and clipped off and so on, Eugene Wigner showed up with the famous flask of Chianti, about like this, and he poured into a paper cup and everyone drank it very quietly. There was no toast . . . nothing . . . no remarks . . . very dramatic . . . the most effective kind of drama at that point.

I am sure everyone was thinking immediately ahead to the bomb from that minute on . . . We were in a war . . . My brother was running a flamethrower in Okinawa when we dropped the bomb on Japan. Maybe we needn't have done it, but if we'd had an invasion, it's clear there would have been millions of casualties on both sides. And my brother would have been in the first wave of the invasion." . . . Leona Libby



We live in The Atomic Age. Tomorrow's power is here, and we will live to see most of our electricity come from the atom. Huge plutonium-producing reactors, direct descendants of CP-1 will make their own fuel, and desalt water to irrigate the desert. Tomorrow's medicine begins with the atom. In chemistry and industry we benefit more and more from the new technology. And who can say where it all began.

We are all part of a silver chain that leads from Greece and stretches out of sight. CP-1 was not the "key that unlocked the door." Rather, it is a shining link in a complex and elaborate chain of events . . . a gleaming marker on a rising curve of scientific knowledge which has changed the world.

Who can say when The Atomic Age began. CP-1 is a convenient point to say: IT BEGAN ABOUT HERE.

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THE UNIVERSITY OF CHICAGO MAGAZINE

Mrs. Szilard —
Pls. see Pages 3-7.
George N. Lekhagoff

MARCH/APRIL '73

THE UNIVERSITY OF CHICAGO MAGAZINE

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COVER: *Although her article in this issue deals with her experiences as a botanist in South America, Patricia Armstrong* (SM'68) *appears here as photographed on a previous expedition, to the Juneau ice fields of Alaska.*

PICTURE CREDITS: *Page 1, Mary Ann Tiffany; Pages 5, 7, Town and Country; Page 8, 9, Charles Armstrong; Pages 11, 12, 16, Patricia Armstrong; Page 31, Lynda Caspe.*

Three questions

About the sustained nuclear chain reaction

1. How would the development of atomic energy have gone, if it hadn't been for the war?

2. Who invented the chain reaction, anyway? (Since this is just a question of fact that some of you may know, I also ask Question 2B: When was the invention made?)

3. This question is really a pointed one which I like to raise whenever I stand in front of a captive audience with representatives from government and business: How important do you consider that the role of knowledge-oriented science was in the development of nuclear energy?

Herbert Anderson

While you are thinking about how you might answer those questions, I'll take you back in history.

It's always difficult to know where history begins. But in my own mind, the story of the development of the chain reaction begins in Sweden. It begins with Otto Frisch, and I thought it would be appropriate to let you have the description of that beginning in his own words:

> This is where I came in, because Lisa Meitner was lonely in Sweden and as her faithful nephew, I went to visit her at Christmas. There in a small hotel in Kungalo, near Goteborg, I found her at breakfast, brooding over a letter from [Otto] Hahn. I was skeptical about the contents—that barium was formed from uranium by neutrons, but she kept on with it.
>
> We walked up and down in the snow, I on skis and she on foot, and gradually the idea took shape that this was no chipping or cracking of a nucleus but rather a process to be explained by [Niels] Bohr's idea that the nucleus was like a liquid drop. Such a drop might elongate and divide itself;

Dr. Anderson, professor in the Department of Physics and the Enrico Fermi Institute of Nuclear Studies, was an original member of the team which achieved the first sustained release of nuclear energy. The accompanying article, recalling some little-known aspects of that development, is excerpted from a talk Dr. Anderson gave in December as part of ceremonies marking the thirtieth anniversary of the achievement. Present at that occasion, which included a symposium on energy needs and policies, were representatives of Congress, the Atomic Energy Commission, Argonne National Laboratory, the business community, the diplomatic corps and the University.

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and when I worked out the way the electric charge of the nucleus would diminish the surface tension, I found that it would be down to 0, just around $Z=100$, and probably quite small for uranium. Lisa Meitner worked out the energies that would be available, from the mass defect in such a breakup. She had the mass defect curve pretty well in her head, and it turned out that the electric repulsion of the fragments would give them about 200 MeV of energy and that the mass defect would indeed deliver that energy so that the process could take place on a purely classical basis without having to invoke the crossing of a potential barrier; which of course could never have worked.

We only spent two or three days together that Christmas, and then I went back to Copenhagen and just managed to tell Bohr about the idea as he was catching his boat to the United States.

And I remember how he struck his head after I had barely started to speak and said, "Oh what fools we have been. We ought to have seen that before." But he had not, and nobody had.

This was exciting news for Bohr. The idea of the liquid drop was his idea and he had been looking for experimental evidence that his idea was the right one. Fission was just the thing. When he arrived in New York, on that January 16, 1939, he was so excited about his new discovery, that he just had to tell it to someone, although he had been cautioned not to let the cat out of the bag before Frisch had done the experiment.

So a few days after settling in Princeton, he came to Columbia looking for Enrico Fermi; he wanted to see Fermi's reaction to his great news. He looked for him in one of the laboratories. Fermi wasn't there, but I was. Undeterred, he came right over, grabbed me by the shoulder and said: "Young man, let me explain to you about this new phenomenon in physics called fission." And he rushed to the blackboard and began to explain how the fission occurred according to his idea of the liquid drop.

It was a fairly exciting experience for me to see such important news from such a great man, and as soon as he left, I felt that I had to find Fermi and tell him what happened. When I got into his office, which was on the seventh floor, and before I had a chance to say anything, he started out, "I know what you want to tell me about. Let me explain to you about fission." He went to the board, and he showed how the two particles would come apart, and the energy yield, and all that kind of thing. I have to say that Fermi's explanation was a lot clearer to me than Bohr's was.

At that time I was a graduate student. I had helped build the cyclotron, and I had just about completed some equipment that I had made for some research that I was going to do in neutron physics. Among other things, I had constructed an ionization chamber and an amplifier, which were the kind of instruments popular in that day, and it just seemed to me that this apparatus might very well adapt itself to seeing the fission process occur.

So I went to Fermi and I said, "Look, you've just arrived and you don't have any equipment, but I have just the kind that would be good for working on fission. Why don't we work together? I need a good professor who understands the physics and you might need a graduate student who's well equipped with apparatus." He appreciated that there would be some problems, because I was already working for John Dunning, but he talked to Dunning; the switch was accomplished, and I began a collaboration with Fermi that lasted twenty-five years.

We didn't lose any time; we mounted a layer of uranium in this ionization chamber, and took it down to the cyclotron in order to bombard that chamber with neutrons, to see if we could see the fission which ought to take place. But the cyclotron wasn't working well that night. Then I remembered that John Dunning had some of these artificial neutron sources that you can make by mixing radium with beryllium. I found Dunning and together we tried it. Lo and behold, we were able to see the fission of uranium on our cathode ray oscilloscope that very evening.

It was a very propitious moment. Fermi had already left earlier that day to attend a meeting in Washington. Dunning, appreciating the significance of our result, telegraphed Fermi that we had seen the fission process. Of course Bohr was there, too, and the whole meeting just blew up with the news. The physicists called up their labs, and very shortly confirmations came from practically every major nuclear physics lab in the country.

Fermi came back to Columbia and straightway called me and wrote on the blackboard a long list of experiments he wanted to do right away.

One of the experiments that we did very early was to try to find out whether new neutrons were emitted when uranium was bombarded by neutrons. We carried out such an experiment with positive results.

An uninvited suggestion

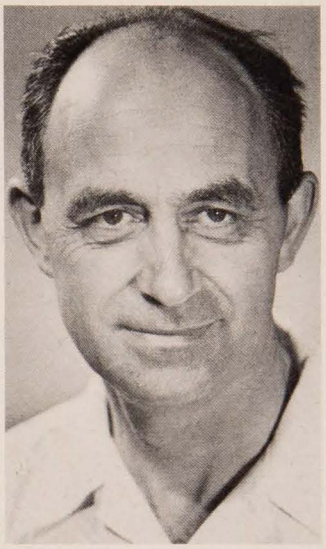
But then in a very curious way, [Leo] Szilard interjected himself into our work.

Just after we finished that experiment he went to Fermi, and said, "You know, Enrico, you are using a radium-beryllium source and you must know that such a source has rather energetic neutrons. How do you know that there isn't an (n, 2n) reaction which would disturb the results?"

"Well," Fermi said, "you may be right." Szilard said, "It just happens that I have a radium-beryllium photoneutron source which gives neutrons of much lower

energy, and if you use that you won't have the problem of the (n, 2n) reaction."

Fermi somewhat reluctantly had to admit that the results would be less open to question if the experiment were done with a photo-neutron source, so we carried out the experiment with that source as well. In the paper describing the results, credit was given to a curious organization known as the Association for Scientific Collaboration, and it always seems strange to me as I look back over history, that not a word was said—that it was really Szilard who had the idea, and it was from him that we obtained the source. Anyway, Szilard then became a part of the Columbia group.



Enrico Fermi

It was curious how he came to Columbia. He was not a member of the faculty. He just sort of appeared one day, because he knew that that's where the action would be. He went to the dean, who appointed him a guest scientist. He then participated in some of the experiments.

Contrasting styles

I remember very clearly how it was, working with Szilard and Fermi. Fermi's idea of doing an experiment was that everybody worked. It was his style to work harder than anybody else, and everyone worked pretty hard. But Szilard was a thinker; he wasn't the one to do manual work. He thought he ought to spend his time thinking; and he didn't want to stay up half the night measuring activities and putting together the various parts of the experiment.

He said, "I realize this work has to be done, but it would be much better for me to spend my time thinking. I will hire a young man who will do whatever is required, and he will do it much better than I could." And so the experiment that we did together was really done by Fermi, Anderson, and a man named S. F. Krewer, although the paper was signed Fermi, Anderson, and Szilard.

It was the first and also the last experiment in which Fermi and Szilard collaborated. The contrast between the Szilard approach and the Fermi approach was really extreme. And it shows how such different kinds of people can succeed in science. Szilard understood this very well.

In fact at one point he pointed out the difference between Fermi's approach and his. When the question came up about whether the chain reaction could go or not, he said, "Well, Fermi and I, we're both conservative in our thinking; according to Fermi, if he sees some chance that the reaction will not work, he doesn't want to say it will; he'd rather be sure of his facts. So he'll continue to work until he can be more certain."

For Szilard, if there's even a small chance that the reaction *will* work, then he feels that he should start taking precautions. He should alert people, tell them what might happen, what the dangers might be, and be ready for the contingencies that might come about.

Although we are primarily concerned with Fermi here, I do want to inject a bit more about Szilard.

Let me tell you in Fermi's own words what he thought about Szilard. He said, "I don't know how many of you know Szilard. No doubt many of you do. He is certainly a very peculiar man, extremely intelligent."

And then, since the audience was amused by this, he said, "I see that's an understatement. He's extremely brilliant. And he seems—at least that is the impression that he gives to me—to enjoy startling people."

Szilard proceeded to startle physicists by proposing to them, that given the circumstances (it was early 1939, and war was very much in the air)—given the danger that atomic energy and possibly atomic weapons could become the chief tool for the Nazis to enslave the world—it was the duty of the physicists to depart from what had been the tradition of publishing significant results as soon as the *Physical Review* or other scientific journals might turn them out.

Instead, he said, one had to go easy, to keep back some of the results until it was clear whether these results were potentially dangerous or potentially helpful to our side. Szilard had that kind of foresight that led to the origin of secrecy in the atomic energy project. It was a hard burden to carry; not so hard during the war, but particularly hard later.

The problem of money

One of the interesting questions is how did we get the money to do the chain reaction? The answer illustrates the difference between the Fermi and the Szilard approaches.

Szilard realized from the beginning that this enterprise wouldn't go unless we could get the money for it, and he also realized that in some way we had to alert the government. Most of you know the story about how he found the way to alert the government through President Roosevelt. Szilard wrote a letter for Einstein to sign; he gave it to Alexander Sachs, who had an inside track, and got it to Roosevelt.

After some weeks, the White House called and said that there was going to be a meeting with Lyman Briggs, the director of the Bureau of Standards, a Colonel Adamson of the Army, and a Commander Hoover from the Navy and they would be willing to meet with the three Hungarians, [Eugene] Wigner, [Edward] Teller, and Szilard, to discuss what was needed in the way of atomic energy. Merle Tuve of the Carnegie Institution of Washington sat in. Here is how Szilard tells it:

"It was our general intention not to ask the government for money, but only ask for the blessing of the government, so that we could go to foundations and raise the funds and get some coordinated effort going. However, these things never go the way you've planned them. In the course of the meeting, Tuve ventured the opinion that the work that Fermi had going didn't require very much, and the most that he could imagine that it would cost would be about $15,000.

"When the representative from the Army heard this, he said, 'Well how much money do *you* need?' And I [Szilard] said, all we need money for at this time is to buy some graphite, and the amount of graphite which we would have to buy would cost about $2,000. Maybe a few experiments which would follow would raise the sum to $6,000—something of that order of magnitude.

"At this point, the representative of the Army started a rather long tirade. He told us that it was naive to believe that we could make a significant contribution to defense by creating a new explosive. He said that if a new weapon was created, it usually took two wars before one knew whether the weapon was any good or not. And then he explained rather laboriously that, in the end, it is not weapons that win the wars, but the morale of the troops.

"He went on in this vein for a long time, until suddenly Wigner, the most polite of us, interrupted him. He said, in his high pitched voice, that it was very interesting to hear this. He had always thought that weapons were very important, and that weaponry is what costs money, that this is why the Army needed such a large appropriation. He said he was very interested to hear that he was wrong—that it is not weapons but morale that wins the wars; and if this is correct, perhaps one should take a second look at the budget of the Army—maybe the budget could be cut.

"Colonel Adamson wheeled around to look at Mr. Wigner and said, 'Well as far as that $2,000 is concerned, you can have it.'"

That's not as funny as it sounds, because that was the first money that the government ever gave in the support of scientific research. And, to compare the budget today to the budget of those times, you can see that Colonel Adamson took a very big step.

And there's also a little dig which I can't resist making. The industrial people didn't show up too well either. Szilard says, "In recalling this period I should mention, that until the government showed interest, I was undecided whether this development ought to be carried out by industry or by the government. And so just a week or two before the meeting in Washington, I met with the director of research of the Union Carbide and Carbon Co., W. F. Barrett. There was some mixup in the appointment, because they expected Fermi, but it was I [Szilard] who turned up.

"There were five people sitting around a table, and I told them that the possibility of a chain reaction between uranium and graphite must be taken seriously. At this point, I said, we could not say very much about this possibility, and that we would talk about it with much greater assurance if we had first measured the absorption of neutrons in graphite. It was for this purpose that we would need about $2,000 worth of graphite. I wondered whether they might give us this amount of graphite on loan. The experiment would not endanger the graphite, and we would return it to them.

"Well, Barrett said, 'You know, I'm a gambling man myself, but you're asking me to gamble with stockholders' money, and I'm not sure that I can do that.'"

Compton's dilemma

How did the project come to Chicago? There were several reasons. One was that this atomic energy project was being run mainly by enemy aliens. There was a war on, and Fermi and those Hungarians were officially enemy aliens—hardly the right people to be in charge of a war project. Furthermore there were two other lines already occupying the Columbia faculty. One was Harold Urey's project, separating isotopes by diffusion through barriers. And John Dunning had a big enterprise, separating isotopes by gaseous diffusion. So Columbia felt that it had about as much as it could handle in this type of wartime activity.

A committee was formed, the so-called S-1 Committee; [Arthur] Compton was a principal member of the committee; there was also E. D. Murphy of the Standard Oil Company and Ernest Lawrence, among others. It was this committee that decided who would run the project. Compton decided that he liked the whole idea and would bring it to Chicago, and that's how it got here. He then called Fermi and asked him if he would like to come to Chicago. Fermi agreed, because Chicago looked like a very attractive place.

It's also interesting to recall how it happened that the chain reaction took place here, on campus. As a matter of fact, the original intention was to construct the pile at the Argonne Forest, a site outside the city. Construction had been going on. But around October 20 there were some labor difficulties, and it was clear that we would be ready to assemble the pile *before* the building was completed. This threatened a serious delay.

Fermi went to Compton to tell him that he believed he could make the chain reaction work safely right here in

Leo Szilard before the erstwhile West Stand at Stagg Field.

Chicago. Compton said, "Let's hear your analysis." When Compton was satisfied that Fermi knew what he was talking about, Compton decided to follow his suggestion.

He did have this consideration: "The only reason for doubt"—to quote Compton—"was that some new, unforeseen development might appear under conditions of release of nuclear energy of such vastly greater power than anyone had previously handled. We did not see how a true nuclear explosion could possibly occur, but the amount of potentially radioactive material present in the pile would be enormous, and anything that would cause excessive ionizing radiation in such a location would be intolerable.

"The outcome of the experiment might thus greatly affect the city, and as a responsible officer of the University of Chicago according to every rule of organizational protocol, I should have taken the matter to my superior.

"But this would have been unfair. President Hutchins was in no position to take an independent judgment of the hazards involved. Based on considerations of the University's welfare, the only answer he could have given would have been no. And this answer would have been wrong. So I assumed the responsibility myself. In the building under the west stands of Stagg Field was a squash court, and I told Fermi to use this room and go ahead with the critical experiment."

An added note from Compton: on November 14, at a meeting of the S-1 Committee in Washington, "I reported what we were doing. When I mentioned that we were preparing to perform the critical experiment on the Chicago campus, faces went white. General Groves rushed to the nearest phone to find out from the Army in Chicago whether in fact, it was impossible to use the new building at Argonne Forest, and it was evident that Groves did not like what we were doing in the least. But I was not told to stop the experiment. Everyone knew the need for speed. The element of risk involved was accepted as a hazard of war."

A prior discovery

The answer to Question 2 comes out of Szilard's memoirs. He says, "In the fall of 1933, I found myself in London. I kept myself busy trying to find positions for German colleagues who had lost their university positions with the advent of the Nazi regime.

"One morning I read in the newspaper about the annual meeting of the British Association, where Lord Rutherford was reported to have said that whoever talks about the liberation of atomic energy on an industrial scale is talking moonshine.

"Pronouncements of experts to the effect that something cannot be done have always irritated me. That day as I was walking down Southampton Row and was stopped for a traffic light, I was pondering whether Lord Rutherford might not prove to be wrong. As the light changed to green and I crossed the street, it suddenly occurred to me that if we could find an element which is split by neutrons and which would emit two neutrons when it absorbed one, such an element, if assembled in sufficiently large mass, could sustain a nuclear chain reaction, liberate energy on an industrial scale and make possible the construction of atomic bombs.

"The thought that this might be possible became an obsession with me, and it led me into nuclear physics, a field in which I had not worked before, and the thought stayed with me even though my first hunches in this regard turned out to be wrong.

"In the spring of 1934 I applied for a patent which described the laws governing such a chain reaction. It was the first time, I think, that the concept of critical mass was developed, and that a chain reaction was seriously discussed.

"Knowing what this would mean—and I knew it because I had read H. G. Wells—I did not want this patent to become public. The only way to keep it from the public was to assign it to the government, so I assigned this patent to the British admiralty."

A botanista's adventures

Patricia K. Armstrong

I went to South America to study the alpine plants. Armed with forty pounds of camping, mountaineering, and plant collecting equipment in my trusty backpack, I bade farewell to my family at O'Hare airport and headed south. I had a round-trip ticket and a nearly forgotten year of college Spanish to help me on my way.

My plans began with several weeks in northern Peru, where the Cordillera Blanca reaches over 22,000 feet and the *puna* (dry tundra) spreads up the quebradas (canyons) between timberline at 13,000 feet and the vascular plant limit at 17,000 feet.

Huaráz was my headquarters in Peru, and while acclimating myself to the 10,000-foot elevation, I tried to find a way to the Mina Huinac. I had read about the rare *Puya raimondii* which grew there at 13,000 feet, and I wanted very much to see it. *Puya* is the largest member of the *Bromeliaceae* (pineapple) family, living for over 100 years and reaching a height of over twenty feet before flowering, setting seed, and dying.

I found out that it would be impossible to go to the mine without spending a lot of money for a special guide and transportation, but there was a refinery located in town that I could easily walk to. Being a somewhat daring individual with a very small budget, I reasoned that the best way to get to the mine would be to ask for a ride on the truck that went from the refinery to the mine. It would obviously be located along the river which flowed through town.

I set out early Thursday morning armed with my ever-present English-Spanish dictionary and a small emergency lunch. I got on board the *colectivo* at the Hotel Monterrey, where I was staying, and rode into town. Soon the vehicle was so loaded with people that it was impossible to see. "I want to get off at the small river," I yelled at the driver. I struggled to the door, paid my two *soles* (five cents) and stepped into the dusty street.

The early morning sun was scorching hot. I pulled my purple, wide-brimmed hat more snuggly on my head and set off. Everywhere ragged little children called *"Gringa! Gringuita!"* and I stopped to smile and return their greeting.

"Hola, muchacho, dónde está la refinadura?" I kicked their soccer ball back to them and admired their baby brothers and sisters. They were shy but friendly.

And of course it turned out to be the wrong refinery. However, the foreman obligingly drove me to his competitor's mill.

"What is your name?" the foreman asked as he got out of the car.

"Señora Patricia Armstrong."

"You wait here, I go talk to the boss." He went inside. A few minutes later he came out with another man. "This is Señorita Armstrong who wants to see the *Puya*." He had ignored the fact that I was married.

I shook his hand. There was more fast talk, then my friend got back into the car. "The truck has already gone to the mine today," he explained slowly so I could understand. "They only go once, in the morning, so they can spend the afternoon fixing the truck. But I have made

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The intrepid author (SM'68) won her Chicago degree with a thesis on mosses and lichens (cryptogam communities) on the talus and cliffs of Devil's Lake, Wisconsin. She has since studied tundra plants and ecology in New England and the mountains of Colorado, Wyoming, Alberta, British Columbia, Alaska, the Yukon and—last year—Peru, Bolivia and Ecuador. She lives with her husband and two daughters and is working in the education department of the Morton Arboretum, in the western suburbs of Chicago.

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in the Andes

Nevada Cayesh, this 18,593-foot peak in Peru, may be the world's most beautiful mountain.

a plan for you. You can go with the truck tomorrow at 7 a.m. Everything has been arranged."

"That's super! But I can't possibly get here at 7 in the morning. I live in Monterrey, five kilometers away. The *colectivos* don't run so early in the morning and I could never find this place in the dark."

"Don't be sad, my Patricia Armstrong, I will come for you at 6:30. Now I take you home, okay?"

"Okay, but I don't even know your name."

"It's Luis, but you must call me Lucho."

"*Gracias*, Lucho."

He let me off right at the door. "Tomorrow morning at 6:30, right here," he reminded me.

Pursuit of the Puya

At 6:30 the next morning, without breakfast, I sat by the door and waited for Lucho. I had packed a small lunch. It was just getting to be daylight.

"*Buenos días*, Patricia."

"*Buenos días*, Lucho, you're very prompt."

He smiled. "Are you ready for the *Puya*?"

"*Si*, you see I have on my hiking shoes, and I have brought my camera and notebook."

"You look like a little boy in those knee pants and big shoes. I have talked to the driver and he has agreed to wait for you while you photograph. You must tell him this—" and he gave me correct Spanish sentences for "I need half an hour to study the *Puya*" and "I'm ready to return now." We spoke completely in Spanish to each other, with a few English words thrown in when he knew one, or when I didn't know the Spanish. There were many gaps in our conversation where communication was lost. We'd laugh and try a different word. I was amazed how fast the long unused vocabulary seemed to come back to me.

"You are kind to do all this for me."

"It is nothing. You are very nice. Now I must hear about your trip today. Will you meet with me tonight at 7 o'clock? I would like that very much."

"Then of course I will."

"I'll pick you up at Monterrey at 7. Now have a good trip. I wish you many *Puya* with many flowers."

"*Muchas gracias. Hasta la noche.*"

The driver was an older man, with many wrinkles. He brought his son and daughter along too, and the four of us crowded into the cab of the truck. The trip to the mine took two and one half hours. I was glad I hadn't tried to walk it.

I got off beside the *Puya* while the driver went on. There were about eight plants above the mine but many, many more a few kilometers on down the road. There were no blossoms, as I had expected, since it was midwinter, but still they were grand. They stood seven to ten feet tall—bristling bunches of sawfish leaves. The driver returned for me and we shared our lunches.

On the way back to town he stopped the truck and they got out to pick the waist-high flowers of *"ichu"* (*Stipa ichu*, the most common *puna* grass). Not wanting to be

left out, I too got out and began picking the grass.

"Why are we picking grass?" I asked the girl.

"To make a broom."

We finally got back to Huaráz about 4:30. It took me quite some time to get a *colectivo* back to Monterrey, since they ran mostly between 8 a.m. and 2 p.m. to suit the marketing times of the natives. When I did get back, I had to take a bath and wash my hair before getting dressed.

I wore my one and only skirt—a dark purple one—with knee socks and a striped knit top. I wasn't the most glamorous woman in town, but at least I was clean and looked like a woman instead of a little boy.

Just before 7 the wind began to blow and it began to rain—a very rare occurrence for August in the dry season. The lights went out at the hotel and we went on candle power until someone started the generator. Soon after 7 a little car pulled up to the door. It was hard to see in the dark. "Lucho?"

"*Si*, get in."

All the lights were off in town too. I expected that he would take me to dinner, since I had had very little to eat all day. (The hotel didn't serve dinner until 8 o'clock.) Instead we turned into a yard. "This is my home. The company pays for it and I stay here when I'm in Huaráz."

"Then where do you really live?"

"In Lima. There I am the number two man with all the mines. I must be here now to talk to the labor organization. We have big problems. Today I didn't eat my lunch until 5 o'clock."

The house was beautiful. It was a light colored brick with dark shutters on all the doors and windows. There was a brick wall around the yard with a zigzag design like rickrack. Flowers grew against the walls.

"Do you live alone?"

"Yes, my wife likes to stay in Lima and my boy has to go to school. Myself, I like it here. I can look out my window to the mountains, and I have much time to read and just relax. In Lima there is always too much to do."

He unlocked the door and stumbled around in the dark to find a candle. "Come in, come in." The candlelight glinted on a huge golden wall decoration across from the door; then we entered the spacious living room. "I have a boy who stays here to keep the house and grounds in shape. There are three bedrooms."

"Why it's grand."

He set the candle on the table by the couch and lit two more. "Would you like a drink?"

"Nothing alcoholic; I don't care for it."

"Me neither—only good wine at dinner. How about a Coca-Cola?"

"That would be just fine."

He went into the kitchen and returned with a bottle and a glass. "Do you like music?"

"Yes, very much. But there's no electricity."

"I have a battery powered record player." He produced it and put on a German record. He had music from all over the world. "My sister and I have a record shop in Lima." He sat on the couch beside me. "Now tell me how your trip to the *Puya* went today."

I jumped up and gestured as I recounted my trip and thanked him for arranging it.

"Did you see any flowers?"

"No, it's not the right season."

"Too bad. Now you must come back to Peru again to see the *Puya* flowers, yes?"

"Yes, that would be nice."

We talked on for hours—almost exclusively in Spanish. On my lap lay the dictionary. I used it often. We discussed our families, the weather, politics. About 11 o'clock he asked, "Would you like another drink?"

"No, but maybe you have a little something to eat. I've had only two pieces of bread, a banana, and a candy bar all day." I thought he could hear my stomach growling by now.

"Oh, my goodness, yes. How terrible of me not to think. Please forgive me." He was almost on his knees before me. His face was twisted in pain. "I didn't think of that. You were at the mine all day. What would you like? A steak? Some fried potatoes? Soup? I'll send my boy out right away."

Before long his invisible boy returned with a multi-stacked set of porcelain pans. We went to the kitchen to eat. He took dishes out of the cupboard and served me the complete five course meal.

"Nothing for you?"

He shook his head. "I ate my lunch very late today; I'm not hungry now. Besides I couldn't eat and look at you at the same time."

I blushed and dropped the chicken wing into the soup with a big splash. He watched me as I ate. It made me very nervous.

"I think that you are a woman of strong character—one who knows just what she wants and goes straight to get it."

"You are very perceptive. Thank you for the dinner."

"It's nothing. It's a pleasure to have you in my house."

"You're very kind."

"Not at all. You're very pretty."

He was leaning closer across the table. The lights came on. I pushed away and picked up the dishes. I went to rinse them in the sink. He came and stood behind me. "Leave them for my boy."

"But it's easier if they have some water to soak." He took my hand and we went back into the living room.

"Your Spanish is pretty good. With more practice it could be perfect."

"That's nice to hear. I don't use the verbs correctly, but I can communicate."

"Your Spanish is much better than my English. I wish I

knew it better. In my work all the important information on mining and machinery is written in English. I should like to go to the United States some day to learn much more."

"Yes, that would be good."

"If I came to near Chicago, would you be there?"

"Yes, of course, and you could stay at my house and I would help you find your way in my country."

"You are very kind."

"No, just like you. I like to help a friend. But it's getting pretty late."

"You want to go? Too bad. I'd like you to stay."

"But some sleep is necessary before tomorrow."

"You could sleep here. I have three bedrooms. It would not cost you anything to stay here. My boy would see that you have all the things you need."

"Thanks, but I must go back to Monterrey and plan another trip for plants."

"What do you do tomorrow?"

"I don't know yet. I must go into the *quebradas*."

"Then I will come to Monterrey at 7. If you come, I will be very happy. And if you don't come, I will be sad."

I nodded and stood up. He took my hands. "You've made me very happy tonight to come with me."

"It was my pleasure."

He smiled and we went out to the car and drove to Monterrey. By the entrance we sat in the car awhile. "Thank you, Lucho, for so much! For the trip to the mine, the talk, the dinner tonight, and everything."

"It was nothing."

"It wasn't nothing to me. You're very kind to a stranger from a foreign country."

"And you are more than wonderful!" He leaned toward me in the dark, and before I knew what happened, he had kissed me fondly on the cheek. I was a little stunned. In the United States I might have slapped him or said something rude, but here I didn't know exactly how to take it. Then I thought of all the mothers and children, uncles and nieces, fathers and daughters, and cousins I had seen greet one another so at the hotel. Close friends and family always greeted each other with kisses on the cheek.

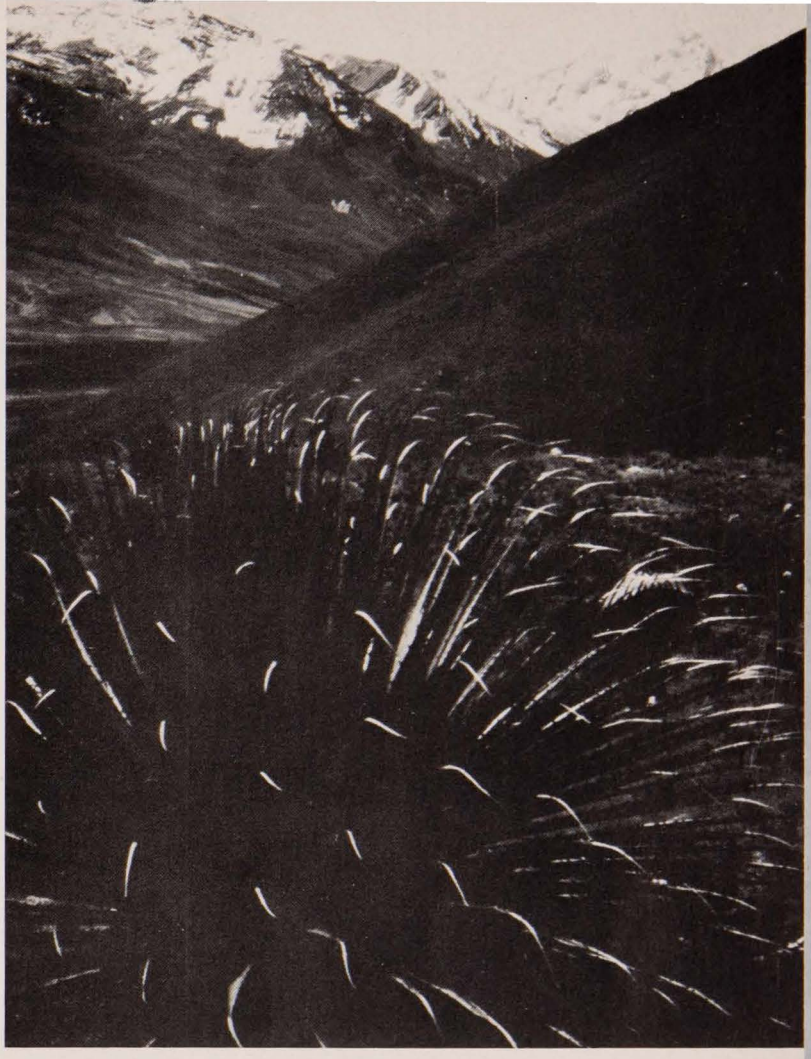
"Good night, my friend, and pleasant dreams," I said and got out of the car.

His hand caught mine on the car door handle. "Thank you again," he said.

"Thank you, Lucho." I hurried into the hotel.

Mountains, friends, and a retreat

I never saw Lucho again, for when he called for me that next night I was making my bed beneath the wild stars some fifty miles away. I had joined fourteen mountaineers for a truck ride to Caras and the beginning of a two-day hike into the Cordillera Blanca. The group was



A young Puya raimondii*; in a century it may grow to maturity. An additional five to six years is required to produce the tall flowering top. The plant grows at an elevation of about 14,000 feet.*

made up of one married couple, twelve men, and me. We planned to camp and climb in the Quebrada Santa Cruz for three weeks and hopefully reach the summit of Alpamayo, Artesonraju, or Quitoraju.

As I went about the task of spreading my foam pad and sleeping bag and then opening my Inca-Cola and can of tuna fish for supper, I looked up to see eleven children gathered around me in the darkness—I suppose because I was the only woman alone.

"Hola amigos y amigas. Como estan?"

They giggled, but soon overcame their shyness and talked freely to me. "Who are you?"

"My name is Patricia. I came to climb your mountains and to learn about your plants."

"What are you doing?"

"I'm making my bed and having my supper. Would you like some of this tuna?"

"*Gracias*." They eagerly passed it around and even licked out the can. I was glad to see it go, since it tasted terribly oily to me. We chatted back and forth. Then they asked, "Would you like us to sing for you?"

"I'd love it." And it was grand. The other mountaineers noticed what was going on by now and joined in the fun. The kids sang to us. Then we sang to them. The songs soon gave way to dancing, acrobatics, and mock fights that kept us awake half the night. But it was worth it.

The next morning I awoke to find a pile of fruits lying by my side like a secret offering in the night. The children came again although they seemed much shyer in the daylight. "Thank you for the fruit. Can I eat it?"

They nodded.

"Tell me about it. What's it called?"

The oldest girl, Carmella, who appeared to be about thirteen but had a baby of her own, stepped forward. It's a *chirimoya.* It's very sweet. It grows on this tree, and here's the *huayaba* next to it. It's not very good."

We talked on. I held her baby while she wrote the plant names in my book for me. At last the burros were loaded and we were ready to begin our hike. I waved goodbye to the children and started up the dusty road.

The sun was extremely hot and the climb was steep. Although my pack was light, I didn't feel very strong so I fell behind. A young man quickly caught up to me, and as he passed we exchanged a few words.

"Buenos días."

"*Buenos días.* Where are you going?" he asked in Spanish.

"Into the Quebrada Santa Cruz to climb and study the plants."

"Are you a botanist then?"

"*Si,* do you know the names of the plants?"

He smiled.

"Then could you tell me what this one's called?"

"Retama."

"And this one?"

"Molle."

And so it went. We walked together, and he wrote the names of the plants for me in the book. Every man, woman, and child I met seemed to know the plants and what they were good for. When they learned that I was interested in plants they were all eager to help me.

At last we reached the town of Santa Cruz at 11,000 feet and Manuel left me at his house. "You are going to pay me for writing down the names for you?"

"No."

"You have lots of money in United States. I think you should pay me."

"I had to work hard for three years to save enough money to come to Peru. I need every bit of it myself. If you were to come to my country, I would name all our plants for you for free, and I would even ask you to my house for dinner, too."

He looked surprised, but his dinner was smelling pretty good, so I just had to add that. He ducked into his house and I went on my way.

"*Señorita.*"

Wheat growing in the Cordillera Negra in Peru—at altitudes in the 13,000-foot range.

I turned. He ran up and placed a fresh baked bread in my hand and smiled.

"*Muchas gracias,* Manuel. You are a real friend. I will not forget you."

After lunch in Santa Cruz, I felt much worse. That sun had been beating down unmercifully all day. The others were complaining of my slow pace, so Victorino, our head porter, took my pack, and I trudged off after him to keep my water supply in sight.

"How come you are going into the mountains?" he asked.

"My husband came down here to climb three years ago. His name is Chuck. Do you remember him? He has a beard."

Victorino nodded.

"Well, he loved your country and your mountains, so he insisted that I had to come this year. It costs too much for us both to come, so he is home with our daughters while I am here to climb and study the flowers."

"The flowers?"

"*Si.* I'm a botanist. I want to know what plants grow in the mountains." So, as we walked, Victorino named some plants for me, and we became friends.

The next day we made our base camp at 13,000 feet and then our high camp at 15,000 feet. I worked as hard as anybody packing supplies and setting up advance camps. I broke my own personal altitude records wherever I went. I got up as high as 17,700 feet on the glaciers and collected flowers all over the Quebrada Santa Cruz. But I kept feeling worse.

On my last day in camp it took me two hours to walk down to base camp, with every step a painful bouncing reverberation in my abdomen. My fever was nearly 103° F., and the leader of the group decided that I had better go back to Huaráz before I got any worse.

One group had climbed Artesonraju and brought me gentians *(Gentiana sedifolia)* from 18,000 feet. We were

halfway through our time, and everyone was in base camp for a huge fresh fish and potato fry that lasted well after midnight.

The next day I tearfully struck my tent and packed my gear for the departure. Everyone came to wish me farewell, and each porter brought me a flower. They handed me their gifts of the strange and rubbery-leaved *Tillandsias* that festooned the sunny, north-facing boulders of our canyon. Then I was helped into the saddle and led unmountaineeringly out of the *quebrada* by Victorino, who was wearing my pack. Through misty eyes I could see the reddish-tipped leaves and brilliant crimson and ochre bracks of the *Tillandsias* bouncing as he walked. Some parts of the trail were so bad I was forced to walk, and it was hard to tell whether it was more painful to walk or ride.

The news of my undignified exit preceded us to Caras, and when we got there after dark, Carmella was waiting with an armload of flowers and some more *chirimoyas.* I couldn't keep from crying. They were all so nice. I had collected almost as many specimens as gifts in one day as I had in the mountains in two weeks.

As I was bouncing over the road to Huaráz in the back of a truck with empty oil drums, ears of corn, sheep, pigs, shovels, and about six other people, I thought to myself—I have managed to grit my teeth through thirteen hours of stumbling horse and jarring truck rides; I really must *not* have appendicitis after all. I gripped my bouquet of *Tillandsias* and other flowers and smiled up at the streaking stars. I was down, but I wasn't beaten yet.

Bolivia; mountaineering by taxi

After a night in the Huaraz hospital, I donned my pack and hiked the seven kilometers back to Monterrey and a hot mineral bath. I still felt weak, but the fever was down, and I had some antibiotics. I went about preparing for the next leg of my journey—the southern *puna.*

I flew to Lima and spent a few days working in the herbarium of the Museum of Natural History and then was off to La Paz. My plane landed at 1:30 in the morning. It was 36°F. and I was dressed in shorts. I hurried into the airport building and wondered where La Paz was. I had seen no sign of lights from the air.

"How far to the city?" I asked the information man.

"Fifteen kilometers."

"How far to the mountains?"

"They are all around. Wait until morning and you will see."

"Is it possible to sleep in the airport?"

"Yes, anywhere, but it is very cold."

Cold! These people didn't know what cold was. I found a little side room and unrolled my sleeping bag and pad in the corner. There were no other planes, and I spent a pleasant, though much too warm, night. The man sweeping the floor early the next morning chuckled curiously when he found me.

After a small breakfast of some pastries brought from Lima and tea at the snack bar, I started out hiking toward the mountains. I could see the big snow mass of Illimani, but I knew that it was too far. I picked a smaller peak that had some snow on it and walked through the sleepy streets of a little town.

Suddenly I came to the brink of a huge bowl-shaped valley, and there, filling it to the brim and spilling over on top of the *altiplano,* was La Paz. The effect was similar to discovering the Grand Canyon. I skirted the bowl to the left, keeping on the *altiplano.* I was at 13,000 feet and didn't want to lose any altitude. Buses switched their way back and forth along the one road leading down into the city.

I had walked for over two hours and was well out beyond the last town when I stopped to rest in a piece of shade and have a bite to eat. A taxi came by. Two young men were riding in front. They slowed to pass and as they went by the driver made a thumb up sign. I raised my thumb and did the same. The taxi stopped and backed up.

"Taxi?" he said. "Where are you going?"

"No, no taxi. I go on foot up the mountain." I smiled at the gringo face of the passenger. "Hi, where are you going?" I asked him in English.

"I don't speak English," he replied in French. I shrugged. What a funny thing! We could have been the only two gringos on the *altiplano,* and we couldn't even talk to each other.

"I don't speak French," I said to him in English. "Do you speak French?" I asked the driver in Spanish.

"No," he said, "but come with us. We are going to the mountain, too." He looked to be on the young side of thirty and darkly handsome. He had longish hair that curled behind his ears, and sideburns fringed his cheeks. He wore a tight-fitting rose-pink shirt that accentuated his shoulders. He had dimples when he smiled.

"I have no money for a taxi. I'll walk."

"No. No." He got out of the car. "The Frenchman has paid. You can come too." He helped me load my pack into the back seat and I got in. "You have no money? Where did you sleep last night?"

"At the airport, on the floor."

"On the floor?" He laughed. "Impossible! I don't believe it. You are all alone?"

"Yes, my husband and daughters are back in the United States."

"That is not good. Up here we have a saying: 'When one sleeps alone it is no good; a woman must have a man to keep up the body heat!'"

"That isn't necessary for me. I have a sleeping bag that is very warm."

"It's not the same. Besides it's dangerous for a woman to travel alone."

"I am very careful. God watches over me."

Just then a policeman of some kind came out of the tall grass beside the road and stopped us. He and the driver carried on a brief conversation. "There, you see!" he turned to me. "Last night there was a taxi stolen near here. He asked me if I had seen anything as I drove out from La Paz this morning. You must be very careful."

I laughed. "No, you are the one who must be very careful. I don't have a taxi."

We laughed together. The Frenchman smiled a little, but he didn't know what was going on. I tried to talk to him about climbing mountains, but I got nowhere. I think he was mad at me for joining his taxi.

The road began to zigzag upwards. It was rough and rocky and quite narrow—hardly more than two goat tracks in the rocks. The Frenchman began to look pale. The driver talked less and concentrated on his driving. At last we found parking beside a ski chalet. It was deserted.

"You don't know how lucky you are to find a car to take you up here this time of the year."

We communicated to the Frenchman in sign language that we were going to walk to the top of the mountain. He wasn't interested at all. "I think the altitude has gotten to him," I said. It was over 17,000 feet, and the wind was very strong and cold.

I pulled a scarf from my pack and also my collecting bags and notebook. "What's this? You really come prepared for everything," he observed.

"Of course, for everything."

We walked. He was always on ahead and waiting for me to catch up. I had just come from several days in Lima and the hospital in Huaráz so I was taking it pretty easy. "Come on." He took my hand.

"No," I pulled away. "I must go slowly and not make my heart beat so fast. I'm not used to this altitude like you."

"Your heart is not used to a handsome man like me. You should listen to your heart."

"You are a little handsome, but my husband is more so. What is your name?"

"Juan, and yours?"

"Patricia."

"Patricia, that's very pretty." We puffed onward, going more slowly now. It took a lot of breath to talk against the wind at 17,000 feet. At last we reached the summit, and he put his arm around my shoulder. With the other arm he gestured to the horizon. "There is Illimani and there Huayna, that means 'wind' in Quechua. You see La Paz? The whole city lies at your feet. I give to you the world; you give to me a kiss, okay?"

"No, kissing someone up so high is very dangerous."

"How so?"

"The air's too thin. You might faint."

"Then sit down and we won't be up so high," he laughed. "I think that you would be more likely to faint than I."

I nodded and pulled away. He could not catch me on the descent. My better shoes gave me the advantage on the slippery rocks. He had to pick each step more carefully.

The Frenchman was sitting in the sun out of the wind. I tried to tell him how beautiful the view had been and how cold the wind was. Juan joined us for a minute to warm up, and then we got into the taxi.

"Where do you go from here?" Juan asked. "I'll take you to La Paz."

"No, not now. I'd rather go to the *ruinas* of Tiahuanaco. Maybe you can tell me how to get there. Can I walk?"

He whistled long. "It's much too far—forty kilometers—but I can take you there after I take the Frenchman back to La Paz."

"No, that isn't necessary. Just tell me which bus to take. I will get along just fine."

He looked a little downcast. "I'll leave you by the road to Tiahuanaco. Look for the bus to Rio Seco. It will get you there. Maybe you will come to the city tonight and I will see you?"

"No, I don't think so. I'll probably stay up here. It's much cheaper than a hotel."

"But it's too cold up here."

"I will manage. Thank you very much. Good-bye."

"No, not 'good-bye,' 'until later.'"

I smiled and nodded, and the taxi drove slowly down the road toward La Paz. The bus to Rio Seco came in a little while, and I got to the ruins all right. I spent several hours there eating, resting, exploring, botanizing, and talking to the people. While I was sitting by the side of the road waiting for a return ride, a man came by riding on a bicycle.

"*Buenas tardes, Señor.*"

"*Buenas tardes, Señorita.* Are you English?"

"I'm from the United States."

"Then you know English."

"Yes." He got off his bike and took some books and papers from the basket and joined me on the side of the road.

"Can you help me with this problem? I'm trying to learn how to speak English, and I don't understand this lesson."

I looked it over. It consisted of groups of sentences to be memorized all involving the idiom "going to."

"Why are you learning English?"

"I would like to speak to the tourists about these ruins and sell them carvings made by the local artists."

"Why that's wonderful. Tell me about the ruins, please. And do you know if this is *llareta*, the famous plant that's burned as fuel?"

And so we talked. He told me about the ruins and the nearby town and his family, and I taught him his English lesson in Spanish until the bus came.

Ecuador: a brusque welcome

When I arrived in Quito, the only thing I knew was the name of the most important botanist in all of Ecuador. Luckily he was in the phone book, and there was a cheap hotel located near his place. I took a taxi to the Hotel Metropolitan and settled in.

I decided to see if I could find Dr. Arnao, and before long I was climbing the stairs to his third floor office. The door was locked, and no one answered my knock, so I tried the door across the hall which also had his name on it. I think it was his apartment.

A man came to the door. "When will Dr. Arnao return? It's very important that I see him, " I said in my best Spanish.

"The doctor cannot be bothered now. Come back at 3." He nearly pushed me down the stairs and then locked the stairway door so no other intruders could get in.

When I returned at 3, I was surprised to see the same man. "Are you Dr. Arnao?" He was in his fifties at least and shorter than me. He had a squarish face and a small mustache. His hair was very, very dark.

"Yes, and I apologize for this afternoon, but I was at a very important meeting and couldn't be disturbed."

"I understand. It was rude of me to just come right up, but I need your help."

"You're American, aren't you?" He switched to English. "What is your business, and how can I help?"

"I'm a botanist and I've collected plants in Bolivia and Peru in the *puna*. Now I want to collect some plants here in the *páramo* of Ecuador, but I don't know where to go or how to get there."

"You're a botanist? You're much too young and pretty."

"I've come to you because you're the most important authority on Ecuadorian plants. Can you help me arrange field trips while I'm here in Quito? I'll be here a week."

He questioned me about my background and my work. Then he told me much about his work and the time that he had visited Chicago many years ago. I had seen his name on many specimens at the Field Museum of Natural History, where I studied for my trip.

"You must not tie yourself down to a family and children," he advised. "Devote your total life to science. While you are here you must not tell anyone about your husband and children. Spanish men do not like their wives to have jobs and run around alone. When you get back home, you should leave your family, if you can, so you will be able to study and publish and make a great name for yourself in science."

"But it's not necessary that I leave my family to do that. I have already studied the tundras in much of the United States, Canada and Alaska. Now I am down here. My family does not tie me down."

We talked about my plans for hours. It was nearly 7 o'clock when we finished, and he said "I have worked very hard all morning and early afternoon today. I think I'll take a small vacation. Let's go out for dinner and then maybe to the movies. But please, Miss Patricia, put on long pants. When I see you in short pants, I think you are bad woman. Now I know how good you are, but please put on long pants for dinner. I'll pick you up at your hotel in fifteen minutes."

"I'll be ready." And I was. It didn't take too long to slip my wool knickers on over my shorts and comb my hair.

We went to a Chinese restaurant nearby that featured real Ecuadorian dishes with Chinese sounding names. The food was good, and he bought plenty. We had extra soup and ice cream and cake and pop and talked on into the night. He told me about the Galapagos and his research in the jungle. "I work all of the time—in the field—at home—at night."

"But it's so exciting to work on all those projects, to do all those things. You have done so much to further the science of botany in South America."

"I only wish my wife felt the way you do. For many years now we have been separated. She didn't understand my work—that I must do it. She always wanted me to go places with her instead of tending to my work."

"That's too bad."

"And my secretary and the students who work for me are sadly lacking in scientific skills. They are constantly typing my manuscripts with the scientific names all wrong."

Suddenly he asked, "Do you feel like a movie? I think we should go to a movie."

"I'm really rather tired, and tomorrow I must be up early to climb Pichincha."

"I rarely go to movies. We'll just walk by and see. If it is a good show, we'll go. If not, I'll take you home, okay?"

"Okay."

When we got to the show, the sign said people under eighteen not admitted. "It doesn't look too good, does it?" I suggested.

"It looks okay. Let's go." The owner was a friend of Miguelito's. We nodded as we passed inside for free.

The first film was in Spanish and lacked a plot. There were a lot of men ripping the clothes off women and dragging them into the next room. The second film was in Russian with Spanish subtitles. It was much better. At least it had a plot, and I could read the Spanish better than I could listen to it. We finally walked back to my hotel after midnight.

"Thank you for the dinner and the show and all your help in planning my field trips."

"Thank you for going with me. You are nice company. Tomorrow I will call you at 4 to see how you have done on Pichincha."

"It's nice of you to do all this when you're so busy."

"It's nothing. You have made my job more fun today. I was on vacation tonight. Good luck tomorrow. Be sure

to wear your long pants, and if the clouds come in, hurry down off the mountain."

'Work, work, and publish, too'

I didn't see Miguelito again until just before the weekend. I had climbed Pichincha and visited the Forest Service tree farm and climbed part way up Cotopaxi. I had collected many plants and spent Friday exploring the shops in town and pressing my specimens. Early that afternoon he called.

"Miss Patricia Armstrong? I've been so busy, busy, busy lately with these meetings that I still can't be with you tonight. And what is worse, tomorrow I can't go with you to Urbina. I'm so sorry, because it was to be for me much fun to go with you in the field at Urbina."

"Don't be sad. My plane flight has been changed to early Sunday morning so I can't go to Urbina. Instead maybe I could go north tomorrow. Would it be possible to go part way up Cayambe?"

"Yes, I think so. Come right over now. You must come quick. I have a meeting at 4, but I must give you the book I promised and make your plans for Cayambe with you."

"I'll be right there."

He met me at the door. "Come in. How nice to see you, but I am sorry I cannot go with you to Urbina. I can't even eat with you tonight."

"I understand. You mustn't give up your important meetings just for me. I am getting on just fine with your help. I have fifty plants from Pichincha and forty-seven from other sites."

"Did you get all the grasses?"

"I don't think so. I'm sorry, but they are hard for me. There weren't many with flowers, and without flowers I can't tell them apart."

"But the grasses are very important."

"I know. Next time I'll do much better."

"I think that when you come again to Ecuador you won't go back. You will stay for life."

"No, I don't think so. Ecuador is very nice, but I like the seasons to change and the days to get long and short."

"No, you don't understand! I mean the next time you come to Ecuador I will not let you go. I will put you in jail."

"But I wouldn't be happy in jail. I need to be free on the mountains—in the *páramo* to see my plants."

"Ah, yes! When you come back I'll take you on a field trip that will last the rest of your life. You don't know how lonesome it can be to be a man alone. I have my work and that is all. There's no one close to understand or share. You understand. Someday you will be a great scientist too. But you must work, work, work, and publish too. Promise me that when you get back to the United States you will work on this paper right away."

"I'll probably not have time until winter."

"Promise you will write the paper or I'll not let you go now." He put his warm hands on my knees. "A good woman like you shouldn't wear short pants. It talks to men."

"I'm sorry, but you said to come right over, so I did. I didn't take time to change."

"Aren't you cold?"

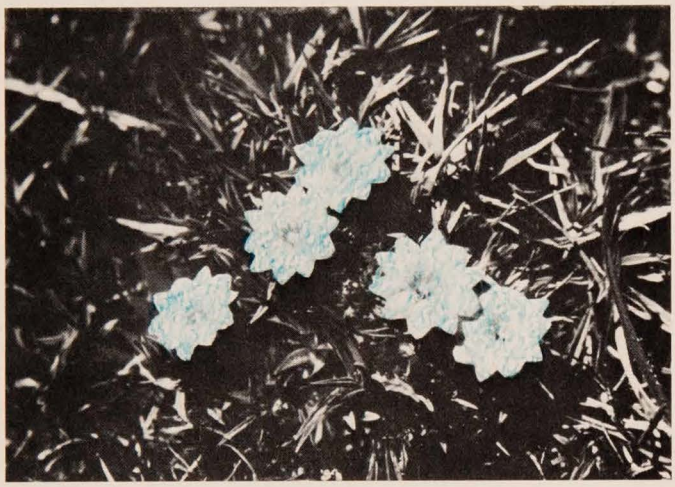
"No, I'm used to wearing shorts."

"On the *páramo*?"

"Sometimes."

"We have a saying here—how can I tell you? One alone to sleep is cold, but a man and a woman together keep up the body heat. I cannot translate it exactly for you."

"I've heard that before, but I do not believe it."



Gentiana sedifolia *(the little flower, blue or white, is about 1 cm. in diameter) grows as high as 18,000 feet in the Cordillera Blanca.*

"I believe it, and when you come again to Ecuador, it shall be for life, and we shall be together. But now I have the book for you. And Dr. Williams is on his way. We must go to a conference tomorrow. That is why I cannot go with you. I will be at the conference, but my heart will be with you."

"No, I think your heart will be much better if it is in your work."

"You are right. You understand. Good-bye now. Remember your science—to work and publish."

"I will and thanks for everything."

"Don't thank me. Just come back to me." He shook my hand in a businesslike manner, but I felt something more than business in his grip. After a few silent moments, he let my hand slip from his. I turned and quickly descended the stairs to the street below.

The plane ride home took many hours. I had a long time to think about my hundreds of plant collections and my several, wonderful friends. It had been a terrific adventure, and already I was planning another visit.

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'We're here to stay!'

Though still distinguishable from the fields of Elysium, the University's neighborhood has come a long way in two decades, as this retrospect by a veteran Hyde Parker indicates.

Ursula Batchelder Stone

Twenty-one years ago, Lawrence Kimpton, chancellor of the University of Chicago, assured an overflow crowd of scared and indignant Hyde Parkers at a mass meeting in Mandel Hall: "We're here to stay and we are going to maintain an integrated, middle class community of high standards."

At the time, Hyde Park had one of the highest crime rates in the city and older residents were following the familiar pattern of running away. Parts of the community were rapidly becoming slums as landlords converted what had been commodious one-family apartments into smaller units, each housing a family. Hyde Park was subject to the population pressure of the expanding over-crowded segregated housing areas to its north and west.

Luckily for the University and for those who wanted to stay in Hyde Park because of the proximity of the University, the convenience of the location, the presence of interesting neighbors and the small-town atmosphere of Hyde Park, something constructive *was* done to correct the situation. I was privileged to be a part of the "something."

Several community organizations had been wrestling with community problems over the years but so far had not been successful in stemming the deterioration. But one of these, the Hyde Park Community Council, whose membership was made up of representatives from the various institutions and churches in the community as well as businessmen's associations, the PTAs, the IVI, etc., took the initiative in deciding that the time had come for decisive action and called a mass meeting in Mandel Hall.

The Council had been formed in 1945 and its purpose,

Mrs. Stone (PhD'29) taught for many years at George Williams College (she retired in 1965); served as president of the Hyde Park League of Women Voters and of the Cook County League; she received an alumni citation in 1960. She was one of the key participants in the establishment of the South East Chicago Commission. She is the widow of Raleigh W. Stone, a longtime member of the School of Business faculty.

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as stated at its organizational meeting, was "to seek and secure an adequate picture of the needs of the community, to have them met by the various institutions, organizations and associations now existing, and to encourage new work that shall meet these needs."

By 1952 most of the neighborhood organizations and institutions, such as the University of Chicago, George Williams College, the Chicago Osteopathic Hospital, the PTAs, churches, synagogues, and local chapters of Kiwanis, the League of Women Voters, the Red Cross, the YMCA, the Hyde Park-Kenwood Community Conference and the Independent Voters of Illinois, were members of the Council.

The continuing effort

By 1952 the Council had striven for and won its battles for a number of things which are now taken for granted—tot-lots; movies appropriate for children at local theaters; mobile x-ray units; a year 'round cleanup campaign carried out with the help of school children; the institution of women traffic guards at school crossings. But crucial problems still confronted Hyde Park. One, which increasingly demanded the attention of the community, was crime and law enforcement.

In February, 1952, the Council adopted Alderman Robert Merriam's suggestion that a community mass meeting be held to "arouse the community." It was to be a meeting concentrating on crime at which ward and police officials could be questioned and those attending could be told just what action the community could take to improve conditions. The response of the community was very evident at the meeting, held at Mandel Hall March 27, 1952, when the hall was filled to capacity.

At this mass meeting various officials, including the current police captain, were asked to account and action was demanded. The meeting ended with the unanimous election of five citizens to serve as an advisory committee to make recommendations for action. The members of the committee were: Chancellor Lawrence Kimpton of the University of Chicago; Rabbi Louis Mann from Sinai Temple; Fred Sprowles, executive director of the Hyde Park YMCA; Hubert Will, a local attorney and an active member of the Independent Voters of Illinois, and I.

This Committee of Five, as it was later called, met almost daily for the next two months, interviewing experts in fields of concern and working to identify the most important areas where action was needed.

From the really furious—and frightened—indignation expressed at the first mass meeting, the committee concluded that it had been given a mandate to improve the safety of the neighborhood in any way possible. Noting the unsatisfactory performance of Hyde Park's police captain, especially as it was exposed during the questioning at the Mandel Hall meeting, the committee proceeded to seek his replacement. With the prestige that Chancellor Kimpton's chairmanship gave the committee, it succeeded in persuading the city police department to send one of its trouble shooters, Captain Albert Anderson, to head up the Hyde Park district. To Captain Anderson goes a great deal of the credit for the results achieved in reducing crime in the area through better law enforcement.

Other unsatisfactory conditions included inadequate street lighting (a condition closely related to police protection, as shown by data on crime reduction in other cities); inadequate municipal services; inadequate enforcement of health and safety ordinances; and corrupt as well as inadequate enforcement of the building code.

To correct these conditions as soon as possible and to assure the community that it really meant business, the committee decided to propose a new organization. In its deliberations the committee gave a great deal of thought to the question of whether any of the many existing organizations in Hyde Park were in a position to carry out the program needed. Nothing would be gained, they felt, if a new organization should merely duplicate the activities of established organizations.

A new approach

The conclusion reached was that none of Hyde Park's organizations at that time represented a broad enough cross section of the community to draw wholehearted support from all the interests involved. The South East Chicago Commission (the name being proposed) should represent *all* community interests—business and religious; liberal, conservative, and all shades between and beyond; civic and social; black, white, and oriental. Its board should be composed of individuals, not as representatives of organizations (as the Hyde Park Community Council was), but as individuals—people whose connections were well known in the community and who could speak as Hyde Park residents.

The committee proposed to select a board of sixty persons, to be elected at a second mass meeting, plus fifteen additional members to be proposed and elected by the board itself at its first meeting. Selecting the first sixty

was no easy task. They should be leaders of recognized ability and should represent a real cross section of the Hyde Park community.

The second mass meeting, which even more people attended, was held at Mandel Hall on May 19. At this time Chancellor Kimpton outlined the program which the committee recommended. Reporting as chairman of the Committee of Five, he noted considerable improvement in police protection and tougher prosecution of criminals.

"In gangland terminology," he said, "the heat is on. This much has definitely been accomplished by our last mass meeting and subsequent activities." He followed with an observation as relevant today as it was twenty years ago: "Now let's not be fooled by this. There is nothing so illusory and ephemeral as a reform movement—unless the reformers go right on reforming. The only way to keep the heat on is to keep the furnace stoked. And this is a job to which every man and woman in our community must be dedicated."

The agenda offered

Chancellor Kimpton's report was greeted with approval and enthusiasm. Establishment of the South East Chicago Commission was wholeheartedly endorsed, and the slate of sixty names for its first board was elected. Chancellor Kimpton, declaring that the committee did not wish to restrict the board of directors of the new organization, asked the approval of those at the mass meeting for only the two most urgent items: (1) crime and police protection, and (2) action on illegal conversions of old houses and apartments. Yet in its report, the committee did list eleven possible projects related to these and other Hyde Park problems.

These included improvement of street lighting; organization of a corps of volunteers to observe operations at the Hyde Park and Woodlawn police stations; a survey of taverns to check compliance with the law; a physical survey of the area followed by maintenance of an inventory on a block-by-block, building-by-building basis; a program of conservation and rehabilitation of existing buildings; a "lock your car" campaign; volunteer crossing guards; organization of block groups; volunteer observers to monitor court hearings on illegal conversions; a program for the control and supervision of neighborhood youth gangs; and cooperation and coordination with other groups.

So, on May 20, 1952, the day after the second mass meeting, the office of the South East Chicago Commis-

sion opened in the Hyde Park YMCA, as a listening post for community residents. Setting up of this office immediately provided a place where people could phone in or bring in reports of disturbing incidents and be sure that someone would both listen to their complaints and take them up with the appropriate authorities. I was asked to direct the office for the summer, or until a permanent executive secretary was named.

Gradually, a temporary staff was recruited and given the responsibility of receiving complaints; watching crime statistics; keeping in touch with the police captain; watching the number of squad cars operating in the area, the number of police on duty (both of which had been increased for Hyde Park's protection); and receiving complaints about illegal housing conversions. As Chancellor Kimpton had said, it was the Commission's intention "to keep watch on what occurs when a property changes hands, and, if any move is made toward illegal conversion, [to] raise hell!"

The summer at the SECC office was very tense. Captain Anderson, new chief of the Hyde Park police, had warned that "every criminal in Chicago" would come to "look us over," and it often seemed as if this were true. It was most reassuring, however, to have the constant cooperation of Captain Anderson. He was in contact with the office several times every day, sometimes even asking the staff to assist him in a little detective work. The additional assistance of Tony Eidson, the University security officer, was also most important.

The office was a beehive. Every day many people came or phoned to register complaints, report a specific crime, or submit information about illegal housing conversions. The Commission office confined its own activity to deal-

ing with crime and the police. When reports of suspected illegal housing conversions were received, they were turned over to the Hyde Park-Kenwood Community Conference, which had had more experience and better facilities for handling them.

Mrs. Julia Abrahamson, executive director of the Conference, provided close cooperation, which proved valuable to both groups.

Growing pains

The Commission office stayed open until 10 o'clock at night, and practically every evening SECC committees met to discuss problems and to draw up "position papers" suggesting policies to the SECC board.

The Commission, as a new organization working at a challenging job, was most threatened by newspaper reporters out looking for a "good story." The Commission had become a top news item but it was important to keep down "tales" which might be misinterpreted. Now and then, some Hyde Parkers, overcome with the desire to play "cops and robbers," reached the newspapers before the office could stop them, or over-eager reformers on the Commission board itself got out of hand and "leaked" stories. Fortunately, it remained possible to function as an alert listening post, handling Hyde Parkers' complaints without undue or misdirected publicity.

Looking back, it is clear that several factors emerge as definitive in permitting this unusual experiment to succeed.

The first and most important undoubtedly was the active participation of the University of Chicago. Where previously all cooperation by the University had been refused, in 1952 Chancellor Kimpton took a leading role in helping to establish the South East Chicago Commission and okaying an initial grant by the University ($15,000) to finance the setting up of the organization. He assumed the chairmanship of the Commission and personally attended all meetings of the Committee of Five. Perhaps the only hope for success in this kind of community venture lies in the existence of a strong institution willing to commit itself and its resources, both human and financial.

Secondly, the serious incidence of crime in the area had created a crisis situation. People realized that "something had to be done." Here, the nature of the community was a basic factor. Hyde Parkers possessed a sense of pride in their community and did not want to see it deteriorate into a segregated ghetto. Many of them had professed a belief in integration over the years and were committed to uphold the principle if possible.

Third, Hyde Park also had a great many community organizations which were concerned with the welfare of the community and had done much work which was very useful to the Commission in setting up and carrying out its program.

Fourth was the skill with which the first board was selected.

Most important of all, in September, Julian Levi, a third generation Hyde Parker, a graduate of the University of Chicago Law School, and a practicing lawyer, became the executive director of the Commission. In the years since, his expertise and vision have been responsible for maintaining, improving upon, and planning new approaches to community problems, including a large-scale urban renewal program—the first in the U.S.—which made the Hyde Park project the success that it has been.

With his astute mind and good judgment and his devotion to the neighborhood, Mr. Levi realized that a "staying action" was not enough. One of his first acts was to arrange for the appointment of a qualified criminologist, Don Blackiston, to work with the police on crime, a most fortunate appointment. Not content with this, Mr. Levi secured a grant from the Wieboldt Foundation to survey the area and see what should be done to restore it. To carry out this planning he secured Jack Meltzer, a competent city planner, who has been responsible for the over-all rebuilding that has taken place. Mr. Levi, himself, worked at all levels, with local and federal officials, with University personnel, with community leaders—in fact, anywhere he felt it necessary.

Gains, but 'unending vigilance'

Former residents or former students, returning to Hyde Park after twenty years, are amazed. Hyde Park has not become a ghetto as predicted. Instead, new residential construction, two new shopping centers, a new mall at the end of 55th Street and many new buildings give the area a whole new look.

And Hyde Park has, in fact, fulfilled its promise to maintain an "integrated middle class community of high standards." In addition, its crime rate, from being one of the highest in Chicago, is now one of the lowest. But only complete cooperation at all levels has made this imaginative program possible, and although Hyde Park has demonstrated that such a program is workable, it still demands unending cooperation and vigilance on the part of the entire community.

Quadrangle News

Optic nerve cells enumerated

The human optic nerve, which transmits visual signals from receptor cells in the eye to the brain, contains 1,200,000 individual nerve fibers, a team of University and Argonne National Laboratory scientists have discovered. The fibers were counted with a computerized image processor that scanned about 500 microphotographs of a cross section of the nerve. The new information is expected to facilitate the study of blindness and eye disease. The scientists are Dr. Albert M. Potts, professor and director of research in the Department of Ophthalmology; Donald Hodges and C. B. Shelman, associate computer engineers at Argonne; Dr. Carl J. Fritz, resident and trainee in ophthalmology at the University; Dr. Norman S. Levy, former resident, now at the University of Florida; and Yvonne Mangnall, former laboratory technician, now at Cambridge University.

Kimball joins Navajo health unit

Chase Patterson Kimball, associate professor in the Department of Psychiatry and Medicine and director of programs in intercultural medicine at Chicago and at Yale, has been appointed to the board of commissioners of the Navajo Health Authority, established to plan, develop, and implement a school of medicine for Indians which will seek to integrate traditional native practices with those of western medicine.

Tuition to rise 2.7%

The University will increase tuition $75 a quarter (2.7%), beginning in autumn, 1973. The increase applies to undergraduate and graduate levels, as well as to all professional schools.

The new annual tuition rates for a normal three-quarter academic year will be: College, $2,850; graduate divisions and professional schools, $3,000; Graduate School of Business, $3,150.

Said Jean Allard, vice-president for business and finance: "Costs of education continue to rise and the University, like other educational institutions, must look to all sources of income, including tuition, to sustain the financial demands made upon it."

The University hopes to be able to continue to offset growing student costs through growing resources for student aid.

Breast cancer study wins backing

A contract for $117,000 from the National Cancer Institute for a study on the biochemical nature of hormone dependency in breast cancer has been received by the University. Principal investigator under the grant is Eugene De Sombre, assistant professor in the Ben May Laboratory for Cancer Research in the University's Division of the Biological Sciences and Pritzker School of Medicine.

De Sombre, a specialist in estrogen research, will study how the female sex hormone and other hormones interact with mammary cancer cells and affect the cells' activities. Normal tissue and cancers that need estrogen for growth and others that can grow without it will be contrasted. The research will seek differences that could explain why the hormone loses its ability to regulate growth as cancer progresses.

Blackfriars time again
What is in the box? Luke Larkin makes a surprising discovery in Blackfriars' 1973 original musical comedy, "Struggling Upward," based on the Horatio Alger novel, *Luke Larkin's Luck*. Directed by Enid Rieser, the show will open in Mandel Hall April 27.

Kudos

President Edward H. Levi has been nominated as an officer in the Order of the Legion of Honor . . . One distinguished alumnus, **Dr. Walter L. Palmer** (SB'18, SM'19, MD'21 [Rush], PHD'26), and one faculty member, **Dr. Daniel X. Freedman,** Louis Block professor and chairman of the Department of Psychiatry, were among ten American medical educators and researchers given 1973 distinguished achievement awards by *Modern Medicine* . . . **Soia Mentschikoff**, professor in the Law School, is the new president of the Association of American Law Schools, the first woman to hold that title . . . A new study discloses the University's Midwest Administration Center ranking No. 1 among eighty American institutions in the teaching of educational administration . . . The University's "A" chess team won top honors in the Pan American Intercollegiate tournament in Columbus in December . . . **Theodore W. Schultz,** the Charles L. Hutchinson distinguished service professor emeritus in the Department of Economics, Chicago, has been awarded the Francis A. Walker Medal by the American Economic Association.

Letters

'War crimes' article excites controversy

TO THE EDITOR: I have been poring again and again over the article by Marcus G. Raskin, page 17, in the November/December issue. This made an unusual impression on me. Why hasn't the theme of this article appeared more frequently? May I suggest that there be more articles like this in future issues. And I would like further discussion on the Kellogg-Briand Pact (the Pact of Paris) and explanation of to what extent it played an important part in leading to the war trials at Nuremberg and later to the war trials in Tokyo.

Are there reprints available of the Raskin article?

CONRAD E. RONNEBERG, PHD'35
Granville, O.

Reprints are available from the MAGAZINE. *For information write the editor.*

TO THE EDITOR: This is one of what I hope and expect will be hundreds of letters protesting your unbalanced publishing of the Raskin article in the November/December issue of the *Magazine.* It presents without an opposing or balancing statement a position which is ultra New Left from beginning to end.

Mr. Raskin's stance is that it is right to oppose the aggression by fascists, as we did in 1941-1945 in that bloodiest of all wars in modern times, but that resistance to communist aggression is criminal. He destroys a part of his case with his own words:

"The Allied and *especially the American* [italics mine] position at Nuremberg was that any resort to war—to any kind of war—is a resort to means that are inherently criminal."

If the Raskin article represents the position of the University of Chicago, it portrays a position completely separated from the dedication to scholarship which I have always associated with that institution.

RAYMOND E. HAYES, PHB'28
Des Moines, Ia.

TO THE EDITOR: Leo Rosten had no need to explain the meaning of *chutzpa* in his article in your November/December issue. The insane diatribe on "war crimes" is a better illustration than any he could pick.

North Vietnam, supported by Russia and Red China, has violated the Geneva agreement and is waging a war of aggression against South Vietnam. The Reds are committing atrocities worse than those of the Nazis. Communists and their allies everywhere have for half a century carried on a criminal conspiracy to enslave the entire human race and to murder all who resist. They have conquered many nations and slaughtered tens of millions of people. They have rarely met with more than token opposition.

The United States, which could easily have destroyed them, has not only refrained from doing so, but is helping the North Vietnamese aggressors through gifts to Red China and Russia; and we are about to sell out our South Vietnamese ally, asking only a face-saving charade from the enemy. All these facts are too well known to be questioned by any sane person. Yet Marcus Raskin accuses the United States of guilt for war crimes. It's hard to believe he is serious.

LAURENCE LEE HOWE, AM'38, PHD'41
Louisville, Ky.

TO THE EDITOR: This is to express my appreciation for the splendid piece by Marcus Raskin in the last issue of your fine magazine. It may arouse some disagreement of course, but Raskin's point of view needs to be heard, and answered if that is possible.

BERNARD C. KIRBY, X'33
California State University
San Diego, Calif.

TO THE EDITOR: In Marcus G. Raskin's article on war crimes we are told with Olympian finality on whose side the Gods are. A legal brief precedes an assumed and unproved categorical assertion that the opponents to America's intervention in South Vietnam "have been correct in their instincts and views on the war" and those who generated and prosecuted it were morally wrong.

This arrogant statement by exploiters of war weariness is a fine example of the Machiavellian assumption of a separation between statecraft and morality. A war was lost; and those who played so great a role in its defaults now turn to flagellation and scapegoating.

When did the war become allegedly immoral? There was no question of its morality when Camelot intervened in South Vietnam. The then accepted national commitments and national self-interest were its basic pillars. It was still moral in the days of Tonkin Gulf. That subsequently a change of heart did take place, that moral issues began to cover a loss of nerve, are self-evident. Why these happened must be left to future historians. However, for many, in true katharsis, a newly found immorality was related back and became an immorality *ab initio.*

Perhaps it was an old guilt—a refusal to face the inevitable consequences of a sick and deceived leadership that, with a wave of a hand, gave the heart of Europe to Stalin at Yalta. Perhaps it was part of a political movement to restore a Camelot dynasty to the control of the government, which failed when the fates intervened and a President and party were destroyed. Perhaps it was the changes in the social values and commitments of this generation, and the panic flight of its youth to the monasteries. Perhaps it was an adolescent nation still tied to frontier and immigrant isolationism fearing to accept the obligations and responsibilities of a great world power in a complex world subjected to the pressures of a new imperialism aggressively moving to impose a Pax Sovietica on the world.

Whatever there be to the claim of war-immorality in the South Vietnam context, this fiction now runs deep in American life. It has made us a house divided, without a will to support a national conscience. For all this talk of morality, we too are now following the frightened peoples of the world and have closed our doors to man's hope for freedom.

REUBEN S. FLACKS, PHB'23, JD'24
Chicago, Ill.

TO THE EDITOR: It's sort of silly of me to challenge Raskin's article on war crimes, with protests rising over current bombing of North Vietnam. Any audience is going to be very unsympathetic.

But I have a cross-grained streak that drives me into lost causes, especially if they are unpopular.

I wrote previously on the tendency of the media to elaborate ideologies suited to

pleasing some audience [*see Letters, September/October*]. With this in mind, let's examine Raskin's argument:

1. Is it true that the people of Vietnam could not possibly injure the U.S.?

During World War II the people of Czechoslovakia did a great deal of harm to Britain, simply because they and their works became the property of Hitler. Such arguments are capable of perversion, as Mr. Raskin points out—but it is dubious reasoning to reject every argument for which this can be said.

2. If we take Mr. Raskin at face value, the "Nuremberg principles" outlaw war, not to say organizing for war on any scale, as a crime for which no "rationalizations" can excuse us. Since the author concedes that the U. S. criminals may have believed their "rationalizations," "reasons" cannot excuse us either.

To be sure, he dismisses the "rationalizations" as unworthy of mention, and advances "reasons" that are poor excuses for anything—*i.e.*, black strutting, middle-class wealth, American dominance and "imperial responsibility." But surely such specifics are not enough for that generality.

Is it a crime to organize for war on any grounds? For defense against aggressive attack, or to help a neighbor under such attack? What if the neighbor is fighting a "civil war," organized and massively supported by a nation as strong as Nazi Germany against one as weak as 1939 Poland? Are we obligated to let such proxy aggressions run their course until we become the object of aggression? Or is it honest to say that such dangers can be resolved by referral to the United Nations? (Perhaps the war managers of Israel could contribute something to this question.)

To such challenges many intellectuals reply, "Two wrongs don't make a right," or even "War is so terrible, better Red than dead." I am more or less sympathetic toward the second of these views, although I reject the first flatly and will be delighted to debate it with anyone so minded. But my point is that the author has implied a massive generalization with little support except ancient quotations, and proposed drastic legal changes in the U. S. for its sake. Surely the subject deserves more serious consideration first!

3. The author has a tendency to set forth debatable propositions as if they were revealed facts.

He does not define "American imperial responsibility," but most readers will translate this as "American imperialism" and understand thereby some kind of national aggrandizement primarily for the sake of capitalist profits, or for the sheer love of power. Surely such verbiage should be explained and documented, with something better than selected quotations.

Who, among U. S. officials who supported Vietnam, sees violence as our primary means of policy making? To most of us "primary" means something that is first choice and the major mechanism behind any other choice. Mr. Raskin, with his extensive knowledge of World War II, should have a clear idea of how nations act when violence is their primary means of policy making.

Violence, of course, is the *ultimate* means of policy making for any government, from hospitals to empires. But unless Mr. Raskin considers "ultimate" and "primary" equivalent terms, his assertion about "primary means" remains to be proved.

The author claims that our war managers practiced violence, domestic tyranny and aggression against their own people; such powers seem for him the source of aggressive war against other nations, and their elimination is the object of his reforms. In support of this view he compares the U. S. during the Vietnam episode with the Axis powers in a way that suggests these societies were largely equivalent.

There are few periods in any nation's history, to be sure, in which its "Establishment" did not employ violence, etc., against some of its people, despite more or less controversy over the justice of the action—*i.e.*, nobody's perfect. But to imply that the U. S. conducted a terror campaign remotely equivalent to those conducted by totalitarian systems against their own peoples, in peace and in war—is both mendacious and ridiculous.

He even suggests that our evil managers did their worst, yet failed to cow our liberty-loving citizens: "As the war continued, the government escalated its repression of critics, including those in the military who rebelled against insane orders and requests—until it became impossible to order them about" (p. 29). But totalitarian managers do *not* fail, despite tyrannical provocations far worse than any he can cite for the U.S.

I resent [Raskin's] misuse of words and concepts. It amounts to a castration of thought. . . the reduction of useful ideas to impotence. "Democracy" and "people" and "court" used to stand for good things, just as "Fascist" and "tyranny" stood for bad things. But now we have "People's courts" and "People's democracies," and anyone can see what is happening to words like "Fascist" and "tyranny," not to mention "militarism."

4. I am not sure that increased popular control over leaders, as an anti-war measure, does not reach a point of "diminishing returns."

Rather than debate this massive subject at length, I shall refer anyone who is interested to the first and last volumes of Winston Churchill's *History of the Second World War.* Fifty million voters can be wrong, and in certain fields they are more likely to be wrong than the men whose main object of concern is foreign affairs.

I happen to believe, for instance, that in the U. S. before Pearl Harbor the popular will was wrong and Franklin Roosevelt was right. Nobody makes a scapegoat out of the public, of course, while everybody makes a scapegoat out of a Chamberlain; therefore the imperfections of public opinion are seldom properly aired.

But before we go overboard with further restrictions on the President of the United States, perhaps they should be.

ALFRED B. MASON (M.D.), SB'38
Bellport, N.Y.

Raskin's rejoinder

The passions which have been unleashed by the Indo-China War suggest the need for a plan of American reconciliation. Thus amnesty should be given to draft resisters and deserters, as well as to government officials who breached international law, the UN charter, and the judgments at Nuremberg and in the Asian war crimes trials.

But there still remains the question of what we do in the future and how we are to hold government officials to personal account for their actions. It would seem to me that it is not too much to ask that domestic legal sanctions for the violation of international laws and customs of war become applicable to individual government officials if they violate such laws. Thus I would hope that it shall be a violation of American domestic law if American government officials:

- Plan, prepare for, order, approve of or assist in the waging of a war of aggression

or a war in violation of international treaties, agreements or assurances; or

- Plan, prepare for, order, approve of or engage in violations of the laws and customs of war, including but not limited to, (1) murder, torture, ill-treatment, or deportation to slave labor or for any other purpose, confinement in concentration camps, or any other conscious policy of neglect and abuse of civilian populations of another land; (2) plunder of public or private property, wanton destruction of cities, towns or villages, or devastation not justified by military necessity, or other acts of brutality against civilians, insurgent groups and resistance movements; (3) murder or ill-treatment of prisoners of war or persons on the seas or killing of hostages; or

- Plan, prepare for, order, approve of or engage in the following specifically proscribed violations of the laws and customs of war: (1) assassination, (2) mass bombing of civilian populations, or the use of weapons of mass destruction such as nuclear or thermonuclear weapons, (3) the destruction of crops, livestock, or the natural habitat of another state, people or land, (4) the overthrow of the leadership of another nation by force, violence or bribe, (5) the use of biological weapons in whatever form, (6) the use of weapons and projectiles proscribed by the Hague Conventions of 1899 and 1907, (7) entering into agreement with corporate or civic leadership for the purpose of perpetrating the acts proscribed above;

- Conceal, or neglect to reveal, the existence of violations of the above.

I would hope that the U. S. would take the leadership in getting other nations to develop like proscriptions as part of their own laws and behavior.

Mr. Flacks is wrong when he says that "there was no question of its [the Vietnam War] morality when Camelot intervened in South Vietnam" or Tonkin, or that there was a loss of nerve which caused people to become critics of the Indo-China War. The fact is that from the very beginnings of the escalated American commitment (1961–'62) by government officials there was fervent, active dissent from knowledgeable international lawyers and political philosophers who judged the intervention by a legal and moral standard. For example, from our own University, Professor Quincy Wright (who was the American adviser on international law at Nuremberg) and Benjamin V. Cohen (former counselor of the State Department) registered strong disagreement with the intervention on the grounds of statecraft, law and morality. (So did I.)

I want to assure Mr. Hayes that I am serious. However, pinning sanctions on those responsible for planning and carrying out the Indo-China war is not now the crucial issue. Rather citizens must concern themselves with the development of a code of personal responsibility for government officials which will nip in the bud such actions of individual or governmental recklessness (Operation Phoenix, the generation of refugees, carpet bombing) as were manifested over this past decade.

Dr. Mason will be interested to know that there is a law case—*Fleming vs. Page* 67US635 (1863)—which states that the U. S. as a nation cannot fight an aggressive war, although it should be able to defend itself. I agree with this position. The U. S. should use every avenue of the UN—its Security Council and General Assembly—and means rather clearly defined by the UN Charter for dealing with "threats to the peace." Dr. Mason would benefit greatly from reading the speeches of MacNamara, Rostow, Acheson, and Rusk on what I mean by the American imperial responsibility. As the issue relates to Indo-China he will find the statement of these gentlemen in *The Vietnam Reader*, by Bernard Fall and myself. If he would be interested in a more contextual analysis of what that responsibility was and how it worked, I would refer him and others to *Routes of War*, by Richard J. Barnet.

There are always great abstract reasons for undertaking wars. It was fashionable to say that we must fight a "small" war to avoid a large war. With whom? The inevitable reply in the 1965–'66 period of the Indo-China War was that we were fighting in Vietnam to "stop China." Even Joseph Alsop would smile at that view today. Dr. Mason may resent the use of particular words or concepts but it does not change the fact that over this last decade there were conscious government attempts to repress critics of the war, from draft resisters to demonstrators to young military men, by government officials, a few of whom (such as another University graduate, former Attorney-General Ramsey Clark) later came to see the moral and legal travesty of the Indo-China War.

Dr. Mason may believe that popular control over a nation's leader has diminishing returns. However, it seems to me that the current debate in Congress to reassert a Congressional balance with the other branches of government is aimed at such a purpose—one I think of as laudable. It is the beginning of a move to restore a deliberative power to the people and their representatives.

Students cite overzealous editing

TO THE EDITOR: We of the literati in the Pritzker School of Medicine know that the greatest opus of the 20th century, James Joyce's *Finnegans Wake*, is spelled without an apostrophe, not as on page 14 of the November/December issue.
DAVID O. STAATS, on behalf of the Freshman Medical Class

bababadalgharaghtakamminarronnkonnbronntonnerronntuonnthunntrovarrhounawnskawntoohoohoordenenthurnuk!

'Conscience' explicated

TO THE EDITOR; I enjoyed reading Leo Rosten's excellent article, "Irony and Insult," in the November/December issue, but would recommend that he be encouraged to make one slight correction.

On Page 9, he writes: "The French *conscience* bears no relationship to the English 'conscience' (the French word means 'consciousness'), . . ." He is wrong, as I imagine many readers realize.

The French word means "consciousness" but it also means "conscience," as every good French dictionary will show. The *Petit Larousse Illustré* specifies: *"Sentiment du devoir, moralité. . .* CONSCIENCE MORALE, *sentiment intérieur par lequel l'homme se rend témoignage à lui-même du bien et du mal qu'il fait."* This is only one of several meanings, but demonstrates well enough, I believe, that the French *conscience* does indeed have a relationship to the English "conscience."
DAVID G. SPEER, AB'37, AM'39
Professor of French
University of South Carolina
Columbia, S. C.

Conscience-shmonscience, as long as one feels guilty.

Alumni News

Club events

Instead of reporting on meetings already held, the MAGAZINE, *hoping to be of greater service to alumni groups, will, beginning in this issue, announce them briefly in advance.*

CHICAGO, April 3. Bernice L. Neugarten, professor and chairman, Commission on Human Development, and Jerome Hammerman, assistant professor, School of Social Service Administration, will take part in a colloquium on aging.

LOS ANGELES, May 10. Philip M. Hauser, professor of sociology and director, Population Research Center and Chicago Community Inventory, speaker.

MIAMI, March 22. Dr. Allan Rechtschaffen, professor of psychiatry and psychology and director of the Sleep Laboratory, will discuss his research on sleep and dreams.

NEW YORK, March 22. Speaker: Dr. Daniel X. Freedman, chairman and Louis Block professor, Department of Psychiatry.

PHOENIX, April 19. Philip M. Hauser, professor of sociology and director, Population Research Center and Chicago Community Inventory, will speak.

SAN FRANCISCO, May 9. Philip M. Hauser, professor of sociology and director, Population Research Center and Chicago Community Inventory, will speak.

WASHINGTON, D. C., April 28. Annual dinner, with David Broder as speaker. Presentation of the Washington club's distinguished alumnus award.

Class notes

06 T. TORRANCE PHELPS, AB'06, DB'13, retired Congregational minister and chaplain of the California state senate and assembly from 1945 to 1955, informs us that he is "still active, at ninety years of age." Since last March he has addressed some forty civic, service and senior citizen organizations and has many speaking engagements scheduled for 1973. Dr. Phelps lives in Claremont.

13 The will of MARNA E. PETERSON, PHB'13, who died November 24, provided for the bulk of her estate to be held in trust with income to be paid to a family member. Upon the income beneficiary's death, 3% of the trust assets will be distributed to the University as an unrestricted bequest.

IN MEMORIAM: Theodore W. Anderson, AB'13, AM'14.

15 GEORGE CALDWELL, PHB'15, plans to bring his new bride as of October 7—Edna B. McDougle—to Emeritus Club festivities at this year's reunion. "We shall fly up from Florida," he writes. "I want her to see my University."

17 IN MEMORIAM: Clarence Ayres, PHD'17; Arthur L. Bakke, PHD'17; Eugene F. Traut, SB'17, MD'19; Col. William J. Mather, PHB'17, former assistant secretary of UC's board of trustees, known to thousands of students in his days as bursar (1931-'41), died on February 3.

18 E. R. HUCKLEBERRY, SB'18, MD'21, whose many years of medical service in isolated and primitive communities near the logging camps and sawmills of western Oregon are chronicled in his book, *The Adventures of Dr. Huckleberry* (Oregon Historical Society), now in its second printing, was the subject of a biographical article in the October issue of the *American Baptist*. Now retired and living in Salt Lake City, he puts in many hours working for the church. The manual dexterity which served Dr. Huckleberry in the healing arts, is now helping him in his woodworking shop. An accomplished wood carver, he makes everything from costume jewelry and wall carvings to play equipment and toys which he has donated to churches and homes for handicapped children.

MARY LENORE KNAPP, AB'18, AM'19, who died November 13, provided for a bequest of $24,013 in her will to be added to the endowment of the Pritzker School of Medicine.

FRED L. SOPER, MD'18, who was instrumental in successful eradication programs of the *aedes aegypti* mosquito in Central and South America in the '20s, '30s and '40s, said recently that this transmitter of yellow fever is alive and well in the U.S., triumphant over a now abandoned $56,000,000 governmental effort to eradicate it. While emphasizing that this country faces no immediate danger of an urban yellow fever resurgence, Dr. Soper, retired now and living in Chevy Chase, told the *Baltimore News American* that our *aegypti* population has consistently reinfested areas south of the border, where the virus is endemic, by crossing from our southern states into Mexico and now poses a serious threat to South and Central American nations which have spent billions to eradicate—for the most part successfully—their own pests. It was only after years of constant pressure and even outright threats from fellow members of the Pan American Health Organization (PAHO), that the U. S. relented and instituted the eradication program, which died with a whimper in 1969. Neither the eradication program nor its failure received much publicity, but pressure has increased from PAHO and a government-financed study by Arthur D. Little, released last April, urgently recommends renewal of the anti-*aegypti* effort.

IN MEMORIAM: Sallie Sterling Rust, PHB'18, AM'19, registrar of the Ethical Culture Schools of New York City from 1940–'64, granddaughter of Maj. Henry Appleton Rust, one of the first trustees and first controller of the University of Chicago, died January 16 in Brandon, Vt.

20 IN MEMORIAM: Henry H. Dennison, AM'20; Amos E. Taylor, AM'20; Benjamin H. Willier, PHD'20.

21 IN MEMORIAM: Ray A. Cripe, PHB'21; Carolyn Hargan Leland, AM'21; Mary Walborn Marx, X'21.

22 ARTHUR H. NETHERCOT, PHD'22, Franklyn Bliss Snyder professor of English, emeritus, Northwestern University, has published a complete two-volume revision of the long-established *Elizabethan and Stuart Plays* (Holt, Rinehart and Winston). His collaborators in the original (1934) edition of this anthology were VIRGIL B. HELTZEL, PHD'25, and their English professor at the University of Chicago, the late CHARLES READ BASKERVILL, PHD'11. Dr. Nethercot now resides in Colorado Springs.

23 J. ROBERT DOTY, SB'23, MD'26, physician and former Rockledge (Fla.) councilman, was commended for community service by county officials at the Brevard County (Fla.) Fair last fall. November 4 was officially designated Dr. J. Robert Doty Day.

24 SARA KING HARVEY, AM'24, PHD'34, professor emeritus of English at Indiana State University (Terre Haute), returned to that campus for homecoming activities and to receive one of four 1972 distinguished alumni awards. Since retiring, Dr. Harvey has taught in West Berlin and Indianapolis, her current residence, and has done extensive traveling.

IN MEMORIAM: Catherina Clarke Bergeon, PHB'24.

25 Brother CHARLES SEVERIN, SB'25, SM'27, PHD'30, chairman of the biology department of St. Mary's College (Winona, Minn.), has been named to appear in the forthcoming edition of *Who's Who in Ecology*. A Christian Brother for fifty-seven years, he was one of the first to recognize the importance of ecology by initiating courses on the subject in the St. Mary's curriculum in 1935. During the past ten years, he has traveled extensively, helping to organize and implement biology teacher programs in India and the Philippines, where translations of his high school biology textbooks are widely used.

IN MEMORIAM: Robert Cornelius Wingfield, PHB'25.

26 M. KING HUBBERT, SB'26, SM'28, PHD'37, research geophysicist with the U. S. Geological Survey, had an honorary doctor of science degree conferred on him recently by Syracuse (N.Y.) University.

FRANCIS W. PORRO, SB'26, MD'29, has retired as chief pathologist at St. Mary's Hospital, Evansville, Ind., a position he has held for twenty-three years. In tribute, the hospital is naming its new pathology laboratory, soon to be constructed, in his honor. In addition to his hospital duties, Dr. Porro serves as a frequent consultant to state health laboratories and maintains a private pathology practice. "I plan to remain active," he told the *Evansville Press*, "but I think it is the proper time in my life to slow down."

ADDISON W. WILLSON, PHB'26, has won the Omaha Association of Life Underwriters Hall of Fame Award. Mr. Wilson is insurance planning consultant in Omaha for the Bankers Life Company of Des Moines.

IN MEMORIAM: Charles C. Adams, MD'26; Horace Mann Bond, AM'26, PHD'36; Simeon E. Leland, PHD'26; Lien Chao Tzu, AM'26, PHD'29.

27 CORNELIUS OSGOOD, PHB'27, PHD'30, professor of anthropology and associate director of the Peabody Museum at Yale, is a collector of waterfall properties in Vermont, where he vacations. The information comes from Professor Osgood's close friend of fifty years, JOHN KETTLEWELL, X'25, Saratoga Springs, N.Y.

28 HSIOH-REN WEI, PHD'28, has retired as distinguished professor of physics and public affairs at Bethany College and has moved with his wife to Hawaii.

IN MEMORIAM: Anita Gelber (Frederich), MD'28; Arvid T. Johnson, SB'28, MD'32; Joseph D. Teitelbaum, PHB'28, JD'30; Samuel Weingarten, AM'28.

29 MELANIE LOEWENTHAL PFLAUM, PHB'29, and IRVING PFLAUM, PHB'28, returned to New Zealand in October after a half-year overseas visit to their family. The Pflaums, who own a home near Valencia, in Spain, have made New Zealand their home away from home. There Mrs. Pflaum has found the peace and quiet she needs to continue her prolific writing career. Her ninth novel, *The Maine Remembered* (Pegasus Press, Christchurch, New Zealand), set in Castro's Cuba, has just been published and four of her books have been translated into French and German.

DELMAR OLSON, PHB'29, JD'31, has retired as chairman of Mutual Trust Life, Chicago, but will continue as a director of the firm.

30 GILBERT BRIGHOUSE, PHB'30, SM'34, retired psychology professor at Occidental College (Los Angeles) since July, 1971, is currently serving as industrial psychologist for Pasadena's Jet Propulsion Laboratory. He is also involved in a project funded by the National Science Foundation which attempts to transfer aerospace technology to city problems.

ALICE de MAURIAC HAMMOND, PHB'30, SM'32, has been hired as a clinical psychologist on the staff of Mesa County (Colo.) Mental Health Center.

31 CAROLINE HUBERT ELLEDGE, PHB'31, AM'49, has been named chairman of the social work department and director of social services in the medical clinics of the Northwestern University medical school. She will hold the academic rank of associate professor.

J. ALLEN HYNEK, SB'31, PHD'35, chairman of the astronomy department at Northwestern University and exponent of the UFO cause, has published his views on the subject in his new book, *The UFO Experience*. In the book Hynek severely criticizes the report called "The Scientific Study of Unidentified Flying Objects," produced by a committee chaired by Dr. Edward U. Condon, which studied material from U.S. Air Force Project Blue Book files. A consultant on UFOs for the Air Force for twenty years, Hynek established the U. S. program for optical tracking of satellites under which twelve tracking stations were set up around the world as well as a volunteer "Moon Watch" system. At Northwestern he supervised participation in the Apollo and Skylab space projects.

32 ALICE STINNETT SCHRYVER, PHB'32, and ELLIOTT W. SCHRYVER, PHB'34, tell us that they were "married again (never divorced)" last November in the Little Church around the Corner, New York City, on the occasion of their twenty-sixth anniversary. The only attendants were those who have known the Schryvers at least twenty-six years, including NOEL GERSON, AB'34, who was best man.

JOSEPHINE MIRABELLA ELLIOTT, PHB'32, AM'35, New Harmony, Ind., has been named university archivist, under a Lilly Endowment grant, for a project to set up an archival library at Indiana State University, Evansville, for the preservation of materials pertinent to the history of southwestern Indiana.

PAUL G. MODIE, MD'32, Barnesville, O., has retired after nearly forty years of practicing general medicine.

CHARLES WOODRUFF, PHB'32, JD'34, embarked on a new venture recently when he and a partner opened a California men's apparel store, Charles of the Desert, in Palm Desert. In the venture Woodruff is combining his legal savvy—he is presently assistant chief counsel for the corporate legal department of Lockheed Aircraft and for many years has been the firm's senior government contracting attorney—with his partner's experience in many phases of men's store operation.

33 ARTHUR HEIM, PhB'33, and son James are enjoying a successful business alliance as heads of a Chicago equipment leasing firm. Leasing Consultants, founded in 1962 by the senior Heim, who brought in his son three years ago, rents heavy and light equipment, be it a printing press, an ocean-going barge or an electron microscope.

HERMAN S. BLOCH, SB'33, PhD'36, associate director of research at Universal Oil Products, Des Plaines, Ill., holder of some 150 patents in the fields of petroleum refining and petrochemicals, has been elected chairman of the board of the American Chemical Society.

HERMAN H. GOLDSTINE, SB'33, SM'34, PhD'36, IBM mathematician currently working at the Institute for Advanced Study, Princeton, N. J., has been reelected to a four-year term on the board of trustees of Hampshire College, Amherst, Mass.

RUTH KRUMREIG HILL, PhD'33, is a clinical psychologist in Chippewa Falls, Wisc. She is also an ordained Baptist minister.

OSBY L. WEIR, PhB'33, manager of Sears, Roebuck & Company's metropolitan Baltimore/Washington area, has been elected to a three-year term as a director of the Federal Reserve Bank of Richmond.

34 DON W. HOLTER, PhD'34, began a four-year term of service in July as United Methodist bishop of the Nebraska area. During his past fourteen years as president of the fledgling St. Paul School of Theology Methodist in Kansas City, the school increased its capital assets from $105,000 to $5,750,000. But he is almost as proud of another figure—the estimated $1,500,000 in donations that he lost by refusing to accept strings-attached contributions. This loss, he told the *Omaha World-Herald*, was his personal contribution to the school's academic freedom.

DAVID C. COOK III, AB'34, and Betty M. McDowell were married in Lake Arrowhead, Calif., in December. The couple will reside in Elgin, Ill.

LESTER LEE HASENBUSH, SB'34, has been named to the medical faculty of Harvard as assistant clinical professor of psychiatry. The appointment was announced by dean of the school ROBERT H. EBERT, SB'36, MD'42.

EVA DONELSON WILSON, PhD'34, retired home economics professor at Ohio State University, has been granted emeritus status by the school's board of trustees.

35 IRMA WAGNER DUCAN, SM'35, PhD'50, is a research chemist with HEW's Arctic Research Center in Fairbanks, Alaska.

WILLIAM RAY FORRESTER, JD'35, dean of the Cornell University law school since 1963, has announced his intention to resign from the post at the end of this academic year or as soon as a successor is chosen. "The right time for a dean to resign is before people think he should," said Forrester. A specialist in constitutional law, the federal judicial system and arbitration and conciliation, he plans to devote full time to teaching, research and writing.

ALICE C. SHAFFER, AM'35, has won the 1972 alumni medal of UC's School of Social Service Administration for "distinguished service to human welfare." During her twenty years with UNICEF, Miss Shaffer was a pioneer in helping various countries develop long-term child health nutrition and welfare programs.

IN MEMORIAM: Norman R. Sackheim, AB'35; Carl L. Lee, AM'35, PhD'51.

36 RACHEL EGBERT ROBBINS, AM'36, is currently program assistant to the commissioner of social and rehabilitation services in the Department of Health, Education and Welfare, Chicago regional office.

ELAINE OGDEN MCNEIL, AB'36, AM'38, associate professor of sociology at the University of Arkansas main campus (Fayetteville), has been named to a two-year term on the Southwest regional council of the American Association for Higher Education.

MARY MCCALL STUBBINS, AB'36, was honored this fall by the First United Methodist Church, Ann Arbor, Mich., for her thirty years of service to the church as organist.

37 JUDSON C. GRAY, AB'37, AM'37, is spending two years at the University of South Pacific, Suva, Fiji.

ROME TURNER DABBS, MD'37, physician in Aberdeen, Miss., who boasts of delivering more twins than any other doctor, is a seasoned practitioner of hypnotism as against anesthesia to alleviate physical or mental suffering. Hypnotism has been used increasingly by Dr. Dabbs in childbirth, psychotherapy, and to help persons to stop smoking or lose weight. Recently, inspired by an experience in Japan in which he was successfully treated by acupuncture for a bad limp which had developed during his travels, Dr. Dabbs has become increasingly fascinated with that ancient Oriental skill and has already gained a certificate from the Hong Kong College of Chinese Acupuncture. He returned to this country with eight fine spiral stainless steel acupuncture needles, but plans to engage in further study before actually using the technique in his practice.

BLOSSOM TOVROV PORTE, AB'37, has been hired as public relations director of Eye and Ear Hospital, Pittsburgh. Former public relations director at the University of Chicago Hospitals and Clinics, she is a contributor to the travel pages of the *Chicago Tribune* and other newspapers.

IN MEMORIAM: Jean Garrigue, AB'37.

38 PAUL P. PICKERING, SB'38, SM'39, MD'41, San Diego, past president of the American Society of Plastic and Reconstructive Surgeons, has been reelected to a three-year term as plastic surgery representative to the interspecialty council of the American Medical Association.

ELEANOR WRIGHT MACY, AB'38, AM'58, former medical social worker at the University of Chicago Hospitals and Clinics, has joined the professional staff of the Fox Valley Mental Health Center, Elgin, Ill., as a psychiatric social worker.

39 JERROLD ORNE, PhD'39, has stepped down after fifteen years as university librarian at the University of North Carolina in order to return to full-time teaching as a professor in the library science school.

IN MEMORIAM: Rita M. McGuane, AB'39, AM'39; Bernard Smaller, SB'39, SM'40, PhD'51.

40 ROBERT S. MINER, JR., SB'40, assistant to the chairman of the physics department at Princeton University, has been elected treasurer of the 8,000-member Institute of Chemists. He will serve until 1974.

IN MEMORIAM: James J. Paterson, x'40; Howard Bourne, AM'40, PhD'49.

41 SELMA JEANNE COHEN, AB'41, AM'42, PhD'46, is editor of *Dance Perspective*, the quarterly journal she founded in 1959 after abandoning her initial ambition to become a dance critic because of the limited demand for that critical specialty. The publication, which carries no news, no reviews and no advertising, concentrates in-depth on one dance subject per issue.

42 CHESTER LEO SMITH, AB'42, attorney in Los Angeles who was unsuccessful in his recent bid for the judiciary, is helping to organize the World Peace Through Law conference, to be held in the Ivory Coast in August.

MELVIN GERSTEIN, SB'42, PhD'45, mechanical engineering professor and department head at USC, has been awarded a $10,000 grant from the American Gas Association toward basic research into the fundamental combustion properties of natural gas, particularly as related to pollution and safety.

MIRIAM PAPE, SB'42, associate professor of health education at the University of

Wisconsin, Whitewater, has been elected president of the Wisconsin College Health Association.

RAYMOND H. WITTCOFF, AB'42, St. Louis, has been elected a trustee of the Equitable Life Mortgage and Realty Investors, based in Boston.

43

EDWIN S. MUNGER, SB'43, SM'48, PHD'51, president of the Louis S. B. Leakey Foundation for the Study of Man's Origins, recently led, with two black colleagues, a mission from the State Department to South Africa. It was Professor Munger's twenty-ninth visit to Africa. (In 1951, he contributed twice to the MAGAZINE on the subject of Africa.)

ALBERT V. BOETTICHER, AB'43, AB'48, MBA'49, corporate tax attorney for I-T-E Imperial Corporation, chaired a session on current foreign tax developments at the Twelfth Annual Tax Conference, held in Philadelphia in October. Mr. Boetticher lives in Wynnewood, Pa.

44

ROBERT C. SORENSEN, AB'44, AM'48, PHD'54, has been elected vice-president for marketing and research of Warner Communications, New York.

JAMES G. HALVORSEN, AB'44, has been named district sales manager in the Palos Heights (Ill.) office of McKey & Poague, real estate firm.

JOHN P. WRIGHT, SB'44, president of the American National Bank and Trust Company, Chattanooga, Tenn., has been elected chairman of the executive council of the Tennessee Bankers Association.

46

E. R. du FRESNE, PHB'46, SM'57, PHD'62, has been chosen president of Pomeroy, Johnston and Bailey, specialists in water, waste disposal and corrosion problems, headquartered in Pasadena.

MALKAH TOLPIN NOTMAN, PHB'46, SB'47, has been named assistant clinical professor of psychiatry at Harvard medical school. Dr. Notman earned her medical degree from Boston University.

WALLACE D. RILEY, PHB'46, Detroit attorney, is serving a term as president of the state bar of Michigan.

WADE THOMPSON, PHB'46, AM'49, has been made a full professor of English and world literature at State University College, New Paltz, N. Y.

GERALDINE HELLMAN ROSENTHAL, AM'46, became associate supervisor for social studies of the Tulsa public schools on August 23.

CLIFFORD L. WINTERS, JR., AM'46, PHD'49, has been appointed vice-chancellor for administrative operations at Syracuse (N.Y.) University. Dr. Winters has the academic rank of associate professor of adult education and has held several major administrative posts at Syracuse.

47

DONALD BOYES, AB'47, MBA'47, has been advanced to director of transportation for Reynolds Metals Company, Richmond, Va.

RUSSELL R. JALBERT, AM'47, assistant commissioner for public affairs at the Social Security Administration, has been elected to the board of governors of Dag Hammarskjold College, which opened its doors last fall to fifty students, half of them from abroad, in the new city of Columbia, Md.

ALVIN W. ROSE, PHD'47, former UN senior adviser to the Congo in social affairs, is now professor of sociology at the University of Miami, Coral Gables.

MARGARET STEVENSON, JD'47, partner in a Davenport (Ia.) law firm, was one of the keynote session panelists at a symposium on women in law held recently at the University of Iowa.

48

ANE LONGSTREET HANLEY, AB'48, has received her diploma from St. Luke's Hospital School of Nursing (Racine, Wis.) and will become a registered nurse upon gaining state certification. Mrs. Hanley and her husband are the parents of five children, ranging in age from nine to nineteen.

IN MEMORIAM: Harry L. McCloskey, MBA'48.

49

GEORGE MORRISON, PHB'49, has been appointed professor of theater arts at Purchase, the newest branch of the State University of New York. He continues to teach acting in his own studios in New York City, and in November directed "Let's Celebrate," two television specials for ABC.

PIERRE R. GRAHAM, AM'49, was an alternate representative of the U. S. delegation to the seventeenth session of UNESCO, held in Paris last fall. Mr. Graham is the permanent U. S. representative to UNESCO in Paris.

VIVIAN MAX WEIL, AB'49, AM'53, has joined the faculty of Illinois Institute of Technology as assistant professor of philosophy in the liberal arts college.

IN MEMORIAM: George Fouts, PHD'49.

50

KENNETH RIVKIN, AB'50, AM'53, has assumed the position of director of the department for English speaking countries of the Keren Hayesod-United Israel Appeal (P. O. B. 583, Jerusalem, Israel). Rabbi Rivkin would welcome inquiries regarding Israel by anyone contemplating a short or long (sabbatical) visit. "If I can offer assistance to our alumni," he writes, "I would be more than happy to do so."

PATRICIA EDGEWORTH CUNNEA, AB'50, AM'55, PHD'63, political science faculty member at Washington State University for the past thirteen years, has accepted an appointment at Hood College (Frederick, Md.) as dean of academic affairs.

ROBERT JUDD SICKELS, AB'50, AM'54, is the author of *Race, Marriage, and the Law*, published in November by the University of New Mexico Press. A history of the legal status of interracial marriage in the U. S., the book is built around the case of *Loving v. Virginia*, in which the Supreme Court ruled in 1967—when sixteen states still had anti-miscegination laws—that laws against interracial marriage violate the Fourteenth Amendment. In the book, Mr. Sickles, who teaches political science at the University of New Mexico, brings to light a bizarre array of legal curiosities, such as an Arizona statute so involved it made marriage of a mulatto to anyone, even another mulatto, illegal. In a chapter on the legal implications of the *Loving* case, he points out that forms of marriage even less widely approved than miscegenation—homosexual marriage and polygamy—may, in the distant future, become legal as a result of the *Loving* decision.

D. D. WALKER, MBA'50, president of Funk Seeds International, has been named to the board of directors of the Foundation for American Agriculture, a non-profit educational institution made up of farm organizations and business leaders.

51

EMANUEL S. SAVAS, AB'51, SB'53, has accepted an appointment at Columbia University as professor of public systems management.

GEORGE LAWNER, AM'51, PHD'59, who is on a sabbatical leave from the music faculty of Kansas University, is conducting the orchestra for this season's Kansas City Lyric Theater performances of *The Abduction from the Seraglio.*

IN MEMORIAM: Arthur M. McAnally, PHD'51.

52

R. V. LECHOWICH, AB'52, SM'55, professor and head of the department of food science and technology, Virginia Polytechnic Institute and State University, Blacksburg, Va., has been named to the editorial advisory board of the trade monthly, *Canner Packer.*

54

GEORGE K. ROMOSER, AM'54, PHD'58, professor of political science at the University of New Hampshire and chairman of the conference group on German politics, an organization of scholars, received the West German *Bundesverdienstkreuz*, a civilian medal of merit, in October for his contributions in

promoting the study of German affairs and contacts between Americans and Germans. On leave during 1973, Professor Romoser will be at the Institute of Political Science, Munich University, following a period of residency at the Villa Serbelloni, the study center of the Rockefeller Foundation in Bellagio, Italy.

MARY POPKIN BASS, AB'54, JD'57, has been named to head the new Family Court Division, set up recently by the city of New York to handle legal representation of petitioners in proceedings related to juvenile delinquency, neglect, child abuse, persons in need of supervision, and in paternity and support proceedings involving persons who are likely to become public charges.

ST. ELMO NAUMAN, JR., AB'54, associate professor and chairman of the philosophy department at Christopher Newport College of the College of William and Mary (Newport News, Va.), has authored a new reference work—*Dictionary of American Philosophy* (Philosophical Library Publishers, New York)—in which 174 minor as well as major American philosophers are catalogued, along with philosophical terms and general references to American philosophy.

STEVEN POLGAR, AM'54, PhD'56, is one of three translators involved in the recent publication by Harper & Row of *Clouded Sky*, a new volume of the poetry of Miklos Radnoti, the Hungarian poet who was executed by the fascists during World War II. Polgar, whose native tongue is Hungarian and who did the major job of rendering the poetry into English, began to learn about the process of literary translation at the tender age of eleven, when he and several classmates at a Hungarian-run boarding school in Derby, N. Y., were assigned the task of translating into English and then performing one of the traditional Hungarian Nativity plays. In the tricky business of perfecting the English of *Clouded Sky*, from a poetic point of view, Polgar was assisted by SHERWIN J. MARKS, AB'57, and Stephen Berg.

WILLIAM L. STEVENS, AM'54, PhD'71, has been appointed associate vice-chancellor for administrative services for the City Colleges of Chicago.

55 LEROY A. BEVAN, MBA'55, Valparaiso, Ind., has retired after a twenty-four year association with Inland Steel Company.

BENJAMIN C. BOYLSTON, AM'55, has been promoted by Bethlehem Steel to the position of assistant to the vice-president of industrial relations.

MARVIN E. KAY, MBA'55, has moved up to associate department head of the advanced design and development division of the Mitre Corp., McLean, Va. Mr. Kay joined the firm in 1971 after a twenty-year career in the military.

56 JANICE HUBKA ALBERT, AB'56, AB'60, AM'60, and her husband were among those honored in October by the board of trustees of Chabot College, Hayward, Calif., for ten years of service to the school. Both Mr. and Mrs. Albert have taught English there since 1962. Writes Mrs. Albert, "We have seen the school grow from a few prefabs on half an acre in industrial San Leandro to a full campus with an enrolment of 13,000."

IN MEMORIAM: Benjamin S. Gantz, AM'56.

57 BARRY F. SULLIVAN, MBA'57, has been named an executive vice-president of the Chase Manhattan Bank, New York.

WILLIAM HENZLIK, DB'57, has been named editor of the *Christian Advocate*, a magazine for Methodist pastors and church leaders.

GEORGE E. WELLWARTH, PhD'57, professor of theater and comparative literature at the State University of New York at Binghamton, published three books during the fall: *Spanish Underground Drama* (Pennsylvania State University Press); *Themes of Drama* (Thomas Y. Crowell Co.), and *German Drama between the Wars* (E. P. Dutton & Co.). Also founder and editor of *Modern International Drama Magazine*, Mr. Wellwarth lectured in the past year at various U. S. and foreign universities, including the Catalan Summer University in Prades, France, and the Sorbonne. "A scheduled lecture in Madrid last summer," he writes, "was stopped by the police." In 1974 he will be visiting professor at the University of Vienna.

58 RUDY W. BERNATH, SM'58, has been named midwestern regional manager for the Barnstead Company, Boston, Mass.

RICHARD HELLIE, AB'58, AM'60, PhD'65, associate professor of Russian history at the University of Chicago, has been named to receive the American Historical Association's Herbert Baxter Adams prize for a work in European history for his book *Enserfment and Military Change in Muscovy* (University of Chicago Press, 1971). In November, Hellie organized a tercentenary conference, Peter the Great and His Legacy, at the University and presented a paper entitled "The Petrine Army."

59 FLOYD W. KNISS, MBA'59, colonel in the Air Force, has retired after more than twenty-nine years of service and is now with Martin Marietta Aerospace, Denver division, as chief, program production control of manufacturing and test operations.

60 HOSEA MARTIN, AB'60, has been promoted by Coca-Cola U.S.A. to the post of bottler sales manager for the Oklahoma City district. He had been coordinator of sports activities for the firm.

BARRY D. KAHAN, SB'60, PhD'64, MD'65, has returned to Chicago following completion of his surgical residency in Boston and a NIH staff associateship. Now assistant professor of surgery at Northwestern University Medical Center, he is continuing the research, begun as a graduate student at UC, on the substances responsible for transplant rejection. (The progress of transplant rejection research is reviewed in his recent book, *Transplantation Antigens*, published by Academic Press.) Dr. Kahan, who with a colleague performs the renal transplants at the medical center, has received a three-year Schweppe Foundation fellowship.

CAROL RUTH SILVER, AB'60, JD'64, law professor at Golden Gate University in San Francisco and a consultant on poverty law for the Office of Economic Opportunity, has been named to the part-time post of attorney for the San Francisco sheriff's department. In announcing the appointment, San Francisco Sheriff Hongisto mentioned some special qualifications that Ms. Silver has for the job: "She holds a brown belt in karate," he deadpanned, "and has actually done time behind bars." (In 1961 she served forty days in a Mississippi prison for civil rights activities before her conviction was overturned.)

IN MEMORIAM: Lloyd Allen Ferguson, MD'60, associate professor in the department of medicine and assistant dean of students in the Division of Biological Sciences and the Pritzker School of Medicine at the University of Chicago.

61 JAMES R. FAULSTICH, JD'61, vice-president of the National Association of Independent Insurers, delivered the luncheon address at the annual Insurance All-Industry Day, sponsored by the central Illinois chapter of the Society of Chartered Property and Casualty Underwriters last November at Illinois Wesleyan University. His subject was insurance ecology.

MARJORIE QUIMBY, AM'61, former teacher at the University of Chicago Laboratory Schools, has joined the faculty at Ball State University (Muncie, Ind.) as assistant professor of elementary education.

JAMES M. WALL, AM'61, has been chosen as editor of the *Christian Century*, weekly journal of religious news and opinion, and president of the Christian Century Foun-

dation. A United Methodist minister, Mr. Wall was chairman of the Illinois caucus for George McGovern at the Democratic National Convention last year and ran unsuccessfully for Congress in Illinois' fourteenth district.

IN MEMORIAM: Jack A. Worthington, PhD'61.

62 On November 7 HARRY D. LEINENWEBER, JD'62, was elected to the Illinois house of representatives on the Republican ticket from the forty-second district.

LAVAL S. WILSON, AM'62, assistant superintendent for curriculum and instruction in the Hempstead (N.Y.) school district since 1971, has been named acting superintendent of Hempstead schools and is the first black administrator to hold such a position in that district. Mr. Wilson, a former Chicago public school teacher and teacher-counselor for the Chicago board of education, was principal of Central School in Evanston before moving to New York.

63 DAVID S. COLEMAN, AM'63, is now associate professor of education and associate director of the school of continuing education at Rollins College, Winter Park, Fla.

RICHARD W. THURN, AB'63, is teaching philosophy at the University of California, Berkeley, and at the College of Holy Names in Oakland. He is scheduled to receive his doctorate in rhetoric at Berkeley this spring.

64 DEBORAH DASHOW RUTH, AM'64, has been named chairman of the education extension at the University of California, Berkeley. Mrs. Ruth, who joined the extension staff in 1966, was co-instructor during the summer of a media institute for teachers presented by the extension in cooperation with the National Council of Teachers of English.

65 HELEN CHENEY GILDE, PhD'65, professor of English literature, has been elected chairman of the academic senate at Cal-State Long Beach. First woman ever to hold the post, Dr. Gilde thinks the status of academic women has improved tremendously in the last decade, thanks to Women's Lib.

66 KATHY WEXLER, AB'66, Chicago public school teacher, won a TV jackpot totaling $15,000 in cash and prizes last fall on "The Joker's Wild," CBS morning game show. Ms. Wexler was the first contestant to win the cash jackpot in addition to merchandise prizes.

TERRY R. LOCK, MBA'66, has been appointed director of containerboard marketing for Boise Cascade Paper Group, Portland, Ore.

67 ROBERT S. ANDERSON, AM'67, PhD'71, having spent a year lecturing in anthropology at McGill University in Montreal, is now field director of Quaker Service Bangladesh, a rehabilitation project supported by Friends Service groups in London, Toronto and Philadelphia. He also works closely with UNICEF, trying to utilize effectively some of the large quantities of material aid coming into Bangladesh. In Rajoir Thana (89 square miles, population 144,000), where he has been working since the creation of Bangladesh, he has organized a team of fifty Bengalis (mostly volunteers) in the fields of mass-feeding against malnutrition, mass medicine, housing reconstruction, tube-well repair, crafts and village industries. While Quaker Service works at the request of the government's Ministry of Health, Mr. Anderson feels "the presence of outside agencies should be terminated this year so as to encourage fuller expression of the country's autonomy."

DALE E. JOHNSON, SM'67, PhD'71, is physicist-in-charge of the University of Wisconsin's high voltage electron microscope laboratory. The facility, which houses the first million volt electron microscope for primary use by biomedical researchers, is supervised by an advisory committee including HEWSON H. SWIFT, chairman of the biology department and distinguished service professor of biology and pathology at the University of Chicago.

JOSEPH W. NOVAK, MBA'67, has been appointed sales manager for the foam products division of Owens-Corning Fiberglas Corporation, Toledo, O.

THOMAS W. PULLUM, AM'67, SM'68, PhD'71, visiting research associate at the Population Institute, the University of the Philippines, during the past year and a former staff member of UC's Population Research Center, has been named assistant professor of demography in the population department, Harvard University.

68 MARY EASTMAN SEXTON, AB'68, and PORTER SEXTON, AB'69, are in Iceland completing a four-year tour of duty with the Navy. From there they will proceed to Portland, Ore., to Lewis and Clark University where Mr. Sexton will begin work on his MAT degree in physics.

CARL HENRY LAWYER, AB'68, has received his medical degree from the University of Colorado and is now interning in internal medicine at the University of Connecticut Affiliated Hospitals, Hartford.

HEDRIC RHODES, MBA'68, has been promoted by Quaker Oats (Chicago) to product group manager—dog food, with complete marketing responsibility for the Ken-L Ration dog food line. Last year Mr. Rhodes won the firm's annual marketing man of the year award.

69 ALAN M. LAHN, AB'69, has been named director in residence halls, Ball State University, Muncie, Ind.

ROBERT L. POWERS, AM'69, has been certified as a registered psychologist by the Illinois Department of Registration and Education and has been elected president of the American Society of Adlerian Psychology.

70 ALLAN B. FOX, PhD'70, assistant professor of English at the University of Cincinnati, gave a paper at a December meeting of the American Language Association in New York, entitled "Chaucer's Prosody and the Non-Pentameter Line in John Heywood's Comic Debates."

FRAN JAEGER, AM'70, is a mental health planner with the Northwest Indiana Comprehensive Health Planning Council.

JOHN TILELLI, SM'70, and SHARON KEIGHER TILELLI, AM'71, moved recently to Salt Lake City, where John is a medical student at the University of Utah. Sharon is a social worker with the Salt Lake Community Mental Health Center and a field instructor for the University of Utah School of Social Work.

71 SAMUEL D. CLAPPER, JD'71, formerly a law clerk for a justice of the U. S. Court of Appeals, Seventh Circuit, in Chicago, is now practicing law in Somerset, Pa.

JUDITH A. GRIFFIN, MBA'71, has been promoted by the First National Bank of Chicago to assistant manager of the international section.

KAREN E. WILLIAMSON, MBA'71, has been named assistant brand manager for Benson & Hedges cigarets by Philip Morris, New York.

72 JANE MARIE BROWNE, AM'72, has been named assistant director of the adult education resource center, Montclair (N. J.) State College.

JOHN S. CANTIERI and DANIEL I. GOLDMAN, both AB'72, are first-year medical students at Washington University, St. Louis.

HOWARD G. ERVIN, JD'72, is working as a law clerk to a justice of the California supreme court.

JAMIE JOHNSON KELMAN, JD'72, is with the Chicago law firm of Gardner, Carton, Douglas, Chilgren and Waud.

Prodigal son

"Prodigal Son" is one of the works by Lynda Caspe (AB'61) which will be on display at the Bowery Gallery, 135 Greene St., New York, until March 28. In addition to the bronze shown above, the show also includes paintings and sculpture in other media. Miss Caspe minored in art while working for her degree in English at the University; she later earned an M.F.A. at the University of Iowa. After further preparation abroad she studied sculpture with George Spaventa. She has taught at the University, and at the University of Alberta and Newark State.

Better yet, come to the reunion and count 'em.

June 1, 2

Friday: *Class reunions—1918, 1923*

Campus tours

Saturday: *Class reunions—1933, 1943, 1948*

Campus tours

Alumni awards lunch

President's reception

Emeritus Club dinner

Interfraternity Sing—in a new format

Order of the 'C' dinner (May 24)

Medical alumni dinner (June 7)

Hospitality lounge: Alumni House

For information on reservations for the tours, awards lunch, reception or class events, send for a reunion announcement or contact Lisa Wally, Program Director, Alumni Association, 5733 University Ave., Chicago, Ill. 60637.

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