CHEMISTRY—PHYSICS

Nobel Prizes Awarded

➤ UNRAVELING the secret of how the green leaf utilizes the energy of the sun is a scientific goal as important in its probable consequences as the discovery of atomic energy itself.

Compared with the rewards that would come from an artificial duplication of nature's photosynthesis, the amount of money and brains being directed toward this problem is considered to be very small indeed. The researches recognized by the award of the Nobel Prize in Chemistry to Dr. Melvin Calvin of the University of California, Berkeley, are among the few intensive efforts at the solution of this great chemical mystery.

Dr. Calvin has approached this problem from two ends: determining how the biological process utilizes the light energy and how food and other substances are formed. In his laboratory at the University of California he is now working on filling in the knowledge between these two extremes in the photosynthetic process.

Dr. Calvin has had plans and dreams of a really adequate research effort on photosynthesis which would involve a considerable number of millions of dollars of support, comparable to the money that was spent making the atomic bomb and is now being spent on the extensive inquiry on the nature and cure of cancer.

The award of the Nobel Prize for photosynthetic research may catalyze a large effort of this sort with adequate financing from foundations.

Dr. Calvin has spent more than ten years on photosynthetic research using radioactive carbon, trying to resolve the basic steps in the process, which sustains all life on earth. He has been able to trace the intricate chemical mechanism by which plants convert water, carbon dioxide and sunlight into sugars, proteins, carbohydrates and other energy-bearing materials.

With co-workers at the University of California, Dr. Calvin developed the method of using radioactive carbon to follow the complex series of chemical changes carbon dioxide goes through in plants to build larger molecules that eventually become basic foods for man and animals.

Found Secrets of Nucleus

➤ THE TWO PHYSICISTS who won this year's Nobel Prize in Physics each increased man's knowledge of the atomic nucleus, or core.

Dr. Robert Hofstadter, 46-year-old physics professor at Stanford University, Stanford, Calif., was honored for his work using the Stanford linear accelerator to define the structure of the nucleus from the patterns produced when electrons are hurled at a hydrogen target.

Dr. Rudolf L. Mossbauer, now at California Institute of Technology, Pasadena, won the Nobel Prize for discovering in 1958 at the age of 30 that, under certain conditions, nuclei could emit or absorb gamma rays without any recoil, known as the "Mossbauer effect." Using this principle has already allowed scientists to confirm Einstein's principle of equivalence to determine the tiny magnetic field of the iron nucleus, and to provide the most accurate clock yet available.

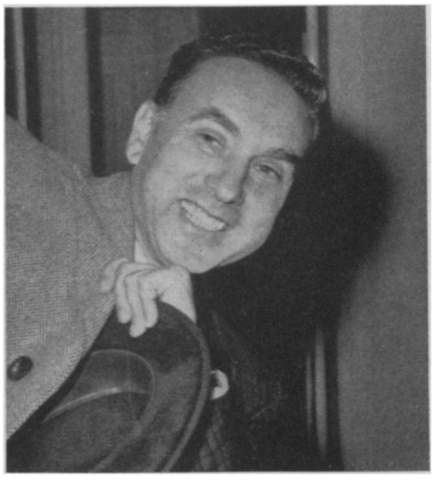
Equally important is the promise of the Mossbauer effect in the field of solid-state physics, from which has come the transistor among other devices.

While at the Universities of Munich and Heidelberg, Dr. Mossbauer showed that some nuclear gamma rays of low energy could be emitted or absorbed without recoil if the atomic nuclei were tightly enough bound in solids and the temperature reduced. Gamma rays are identical to X-rays but are emitted from the nuclei of atoms rather than from the atoms' electron cloud.

Binding the emitting or absorbing nuclei in a solid also eliminates the broadening

NOBEL PHYSICS PRIZE WINNER—Dr. Rudolf L. Mossbauer, right, is receiving the 1960 Research Corporation Award from J. W. Hinkley, president of the foundation. Dr. Mossbauer received this award for the discovery of a nuclear effect that makes it possible to measure energy changes of one part in a million billion.

WORKING ON PHOTOSYNTHESIS—Dr. Melvin Calvin, winner of the Nobel Prize in Chemistry for his outstanding research in photosynthesis, is working in his laboratory at the University of California. Behind him is one of the columns in which he grows algae for his experiments.



HAPPY CO-WINNER of the Nobel Prize in Physics, Dr. Robert Hofstadter, was awarded the prize for his studies of nucleons.

due to motion of the atoms caused by heat. In this way, radiation of phenomenally narrow frequency spread is provided, as well as an absorber perfectly matched in frequency.

The most recent result of the work of Dr. Hofstadter and his co-workers in probing the atomic nucleus is that two of the most fundamental building blocks of all matter appear to be virtually perfect mirror images of each other. They are the proton, which is a positively charged nuclear particle, and the neutron, a neutral one.

The proton is pictured as essentially a tight core of positive electric charge surrounded by two larger, somewhat diffuse and interpenetrating clouds, also of positive charge. The clouds are made up of mesons, the nuclear particles believed to serve as the "glue" holding the nucleus together.

The neutron also has a hard core of positive charge, surrounded by two diffuse and interpenetrating meson clouds. In this case, however, one cloud is negatively charged while the other is positive and extends somewhat farther out from the hard core.

These "pictures" of the neutron and proton were selected as the best fit for experimental information gathered by Dr. Hofstadter and his co-workers from the scattering of electrons accelerated and hurled at hydrogen targets in the Stanford machine. They were "drawn" in terms of the distribution of electric charges within the nucleus.

• Science News Letter, 80:317 November 11, 1961

NATURAL RESOURCES

Increase Oil Yield

➤ A HIGHER RATE of recovery from oil underground wells is the aim of a three-year program at the University of California.

Sometimes as much as 80% of the reserves remain underground after the pumping is finished and the derricks are dismantled.

Petroleum engineers have long looked for another method which could bring up the remaining oil not recovered through the traditional pumping process.

One such method is to flush out the oil with another liquid, but a number of basic chemical and geological problems have to be investigated in the laboratory before the flushing technique can be used in the field.

In trying to flush oil out of the ground, the flushing or pushing liquid is almost always less viscous or more fluid than the oil. The pushing "piston" may be a natural gas, which must be separated from the oil by a "slug," or band, of propane to keep the gas and oil from mixing.

However, in certain porous earth layers the pushing process becomes unstable, causing the band to break down and the gas and oil to mix.

The major purpose of the research, under the direction of Dr. Richard L. Perrine, will be to discover under what conditions such instabilities in the flow process will develop. His fundamental studies, supported by the National Science Foundation, may lead to important future applications, mainly in the secondary recovery of oil.

Other uses may lie in protecting underground fresh water wells from encroaching sea water along the coastal strips, and in a variety of chemical engineering processes.

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INVENTION

Patents of the Week

➤ A MACHINE that can be used to control the fiery energy of the hydrogen bomb's fusion reactions has been patented.

It is called a "rotating plasma device," a plasma being a gas in which the atoms have been partially ionized, or separated into positive ions and negative electrons. Although electrically neutral as a whole, a plasma can conduct an electrical current.

The rotating plasma device will come into its own only after scientists have achieved long-time confinement of a plasma. This is the key to controlled thermonuclear fusion of such light elements as hydrogen, deuterium (double-weight hydrogen) and tritium (triple-weight hydrogen).

There are four basic methods being tested for confining a plasma, co-inventor James L. Tuck of Los Alamos Scientific Laboratory, Los Alamos, N.M., reported. These are the so-called "pinch effect," which has been found to be unstable; the Stellarator, a machine being built at Princeton University; the mirror configuration; and the "picket fence," which is based on cusped geometry.

The "picket fence" method is the most recent and most promising approach, Mr. Tuck said. However, he noted, there are "many, many" combinations of these four methods being tried out at various laboratories around the country.

Patent No. 3,005,767 was awarded to Drs. Keith Boyer, Conrad L. Longmire, Darragh E. Nagle and Fred L. Ribe, and Jay E. Hammel and Mr. Tuck who assigned rights to the Government through the U.S. Atomic Energy Commission.

Their invention relies principally on the fact that an ionized gas can be contained and heated in a region of crossed magnetic and electric fields. Both fields are applied externally, so there is no reliance on the self-generated magnetic field of the plasma current to compress and thereby heat the plasma as in the "pinch effect" approach.

The rotating plasma device is one of the methods for obtaining a high rate of thermonuclear reactions, with more energy liberated than is required to ionize the gas and bring it to the extremely high temperatures necessary for controlled fusion.

A neutronic reactor structure of "novel construction" won patent No. 3,005,764 for Dr. Farrington Daniels of the University of Wisconsin, who assigned rights to the U.S. Government. His invention is a nuclear reactor that can be operated at very high temperatures for the most efficient use of the power generated in the reactor.

Dr. Glenn T. Seaborg, chairman of the Atomic Energy Commission, was awarded patent No. 3,005,680 for his method of separating neptunium from plutonium when both are dissolved in water.

Dr. John Strong of Johns Hopkins University, Baltimore, won patent No. 3,005,913 for an infrared range finder. Rights were assigned to the U.S. Army. He found an improved method for detecting and locating distant objects that, although invisible, send out weak infrared radiation.

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ON THE WAY TO HONOR—Ronald Sakimura says good-by to his mother, Mrs. Kanjyo Sakimura, on his way to the Japan Student Fair.

GENERAL SCIENCE

Hawaiian Pineapples Scientist's Gift to Japan

➤ WHEN Ronald Sakimura, age 15, came to Japan as the representative of about a million young American science fair entrants, he brought with him on his Pan American flight a crate of pineapples, as a gift to his hosts.

This fruit is typical of Hawaii where Ronald lives and won the science fair honors that caused SCIENCE SERVICE to send him to the Fifth Japan Student Science Fair.

The luscious fruit is not unrelated to young Ronald's project as he is an entomologist, specializing on nematodes, which are worm-like organisms in the soil. Insect pests must be subdued in Hawaii, as elsewhere in the world, to allow the growing of commercial crops.

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