

GENERAL SCIENCE

Science Forecast for 1964

Advances in space, atomic power generation and new medical treatments and immunizations are predicted for the new year, while the nation stays alert to atomic attack dangers.

By WATSON DAVIS

► TREMENDOUS scientific undertakings to which the world is pledged since World War II will continue vigorously through the forthcoming year.

These are:

Conquest of space, the building of new atomic power plants, the design and construction of immensely powerful generators of high voltage to explore the atom, the exploration of the earth, and new studies of our sun that affects everything on this globe.

The rivalry between Russia and the United States will perhaps be mitigated by some combined efforts, but this is not likely to reach the ideal that was set forth by the late President Kennedy that there would be cooperation between the two nations in going to the moon.

One by one the great plagues of history are disappearing before medical advances. New ills that affect mankind due largely to the lengthening of human life are also being overcome. Just as the development of new drugs has conquered many of the bacterial diseases, now the virus-caused ills are being prevented by vaccines that immunize. Where immunization is not yet possible, drugs and antibiotics are used to treat or cure many diseases.

More Virus Conquests?

With measles the latest virus disease to be controlled by immunization, medical research developments are turning toward other diseases and the perfection of vaccines against a variety of epidemics. Hepatitis seems next on the list. Perhaps the common cold, a complex of virus diseases, troublesome but usually non-fatal, will come under partial control in the coming months.

The great research campaign against cancer will continue. Large sums of money and research time are being spent in achieving some results. But there has been achieved neither a chemical cure in a class with some of the general purpose antibiotics for other diseases nor an understanding of the causes of cancer which may lead to its prevention. Cancer is not one disease but a large number of metabolic or cell-growth disorders. Not one but many methods of prevention and cure will be needed in the future.

As a consequence of the approval by the United States Congress of Kennedy's four-year, \$329 million program to combat mental illness and mental retardation, there will be constructed in various parts of the nation new community mental

health centers for research and treatment. There will be training of teachers for the mentally retarded.

There will be a shift of emphasis in the care of the mentally ill away from large isolated state hospitals toward community-centered mental health programs that in large part will be made possible by this new legislation, which was one of the successful programs that was implemented before President Kennedy's death.

There is conviction on the part of medical scientists that many forms of mental illness and retardation can be prevented or treated more effectively through the local preventive diagnostic treatment centers than through other forms of large-institution hospitalization that has been customary in the past.

Out of this new attention to mental illness may come research that will provide the cure and explain the cause of the various mental plagues besetting us.

Space Advances Continue

The world's conquest of space, utilizing immense financial resources and scientific talent, will continue at a rapid pace in 1964. Reaching the moon, either for Americans or Russians, is not possible until late in the decade, but preparations for moon travel and tryouts for methods to be used in the moon flights will be made.

One or more rockets that carry instruments will be launched toward the moon to send back information, and there may be an actual landing of manless vehicles on the moon's surface equipped to signal back to earth by TV cameras and sampling devices what is actually on the earth's natural satellite. One of these rockets will carry a seismograph to detect earthquakes on the moon.

The preparations for sending men to the moon will continue with orbiting of space-ships containing teams of two astronauts by both Russia and the United States. So far as planned now, the national teams will be in separate vehicles.

The men-to-the-moon project will gather, as it progresses, more opposition. Already there are warnings from some scientists that there is danger of disaster and loss of life, happily not experienced in the first American manned orbit of the Apollo series. Whether there have been unreported losses of Russian astronauts is not known.

The risk in space experimentation exists, as is evident from the rocket failures during development, which in the United States have not resulted in human fatalities. Whether there will be a change in pro-

gram if astronauts are killed in the manned launches, only time will determine.

If the climate of cooperation between Russia and the United States allows a joint expedition to the moon, this would convert nationalistic efforts on the part of both countries into a world penetration to other parts of the universe. With joint teams of astronauts going into space, the public and official reaction to loss of life would be supportable and would not call a halt to space exploration.

Working With Russia

The two rival nations are cooperating to a very limited extent in sharing results of weather and other subsidiary satellites. Because the moon flights, at the earliest possible schedule, are years in the future for both countries, there will be time enough to bring about international accord if all goes well in more peaceful relationships between the countries.

The exploration of space is based on military progress as the rockets used were primarily created by both nations to launch intercontinental flights of nuclear warheads threatening the rival nation.

Intense efforts of our defense research scientists will continue to remodel our retaliatory nuclear missile controls to make them proof against disablement by the electronic magnetic pulses (EMP) of a surprise nuclear attack.

Scientists are interested in the significant results being obtained from probes and satellites that send data from the space that surrounds the earth.

The United States will launch its first orbiting geophysical observatory that will perform some 20 experiments and link radiations and their effects with the various locations above the earth. The earth's magnetic field, so important in its effects upon many phases of earthly life, will be measured intensively by the scientific instruments carried into orbit by rockets.

Pleased with the results from the first orbiting solar observatory that views the sun from outside the curtain of the earth's blanket of air, scientists will launch into orbit a second such complex instrument.

More Satellites in Orbit

There will be numerous other satellites put into orbit for communications purposes, weather observations and other peaceful purposes, as well as devices to keep secret watch on what is happening all over the world.

Both the U.S. and the USSR continue to have such secret orbiting devices for their surveillance missions.

Like the space program, but much more down to earth, the atomic energy development will during the coming year achieve results for which basic research and development have laid the foundation. The



Hughes Aircraft Company

SYNTHETIC RUBY AMPLIFIES LASER'S INTENSE LIGHT—Dr. Theodore H. Maiman, while working at Hughes Aircraft Company, looks into the heart of the laser (light amplification by stimulated emission of radiation), a scientific achievement that in an extraordinarily short span of years has become an exciting new instrument for scientific research. The tightly packed atoms in the ruby are excited by light which they amplify into an intense parallel beam.

feeding of atomic power into the power lines of the nation may seem to be a slow process. But year by year more nuclear furnaces are placed in operation, and in another decade and a half a significant share of the energy utilized by the nation will come from the fissioning of atoms rather than the burning of fuel.

During 1964, there will be increased attention to atomic power reactors which, as they generate energy, will also convert into fissionable material the kind of uranium that can not fission and thus cannot now be utilized for power generation. This will allow the addition to our potential atomic resources of the great stores of uranium that are available in the United States and in the rest of the world.

The capturing for peaceful purposes of the reaction of the hydrogen and thermonuclear bomb is long overdue. The conversion of light elements, like forms of hydrogen, into heavier elements is a fusion process that releases immense quantities of energy. When this reaction is tamed and slowed down, these atomic transformations will be available for power purposes.

When the United States and the other atomic nations of the world gather at the end of August for the third United Nations International Conference on the Peaceful Uses of Atomic Energy at Geneva, there may be reports of progress in the development of thermonuclear energy, not for war but for peace.

Another great hope for the utilization of atomic energy has been achieved more slowly than it had been expected. This is

the use of radiation from the waste by-products of atomic power production for the pasteurization and the preservation of food. At Gloucester, Mass., in late summer a pilot plant for the pasteurization of seafood by radiation is to be completed. This may make it possible to deliver fresh fish to housewives without going through the process of freezing, canning or drying.

Without sending humans to the other planets, much information about conditions upon them is being gathered by sophisticated instruments that convert what they observe in their space travels into signals that can be received on earth. Space probes will travel closer to the planets Venus and Mars than human beings for several decades. Spying upon the planets will continue during the year since visits by rockets to the vicinity of the planets are on the programs of both the United States and Russia.

Life on Other Planets?

No one expects to find life like ours on any planet of the solar system. It is an open question as to whether there is hope that intelligent beings do exist elsewhere in the universe, even upon earth-like satellites that are presumed to exist attached to some of the billions of stars like our sun in our own and other galaxies. While there will be little publicity during the coming year, astronomers will continue to be alert for any indication of signals, like radio waves, of intelligence existing in other parts of the universe.

Because it is the time of least activity upon the sun in its cycle, 1964-65 are the International Years of the Quiet Sun, when from Antarctica and other parts of the world there will be special observations of sunspots, sun flares and other manifestations that affect the earth so materially.

There will be new "alerts" of sudden sun effects in the ionosphere modifying radio and wireless communications. Just as the successful International Geophysical Year brought nations together in research and added to our knowledge of the earth, so this special solar observation period is expected to add new knowledge.

An increase in the study of vibrations of the earth is made possible by a great proliferation of earthquake-measuring instruments which were spread over the globe because of the need to detect atomic explosions as a part of our defense effort. There will be the beginning of an extended effort to predict earthquakes by scientific methods.

Simplicity in Atom

Those who are studying the interior of the atomic nucleus are bringing simplicity again to the array of so-called fundamental particles. There seems to be growing a consensus of opinion which erases the distinction between "elementary" particles and other particles. The number, when one includes the resonances and the old system of counting, is up somewhere near a hundred now.

Great super atom smashers to create energy as high as one thousand billion electron volts and costing billions of dollars will receive consideration and perhaps authoriza-

tion during the year. These research instruments are needed to understand the fundamentals of matter and solve the mysteries of nuclear particles. From their use in future decades will come discoveries that we can now only dimly imagine but which may rival our atomic and space programs.

Primary electrons in the cosmic rays will be further investigated for the relative fluxes of positive and negative electrons. The relative amounts of helium isotopes three and four in cosmic-ray helium will be elucidated. New attention will be focused on "relativistic astrophysics," and especially on the collapse of supermassive "stars," as heavy as a million solar masses, believed to be a prime source of cosmic rays.

Ways of changing the weather and producing rain will be tested to see whether a practical method has been found in the modifying of cumulus clouds over the tropical oceans. Use of weather satellites and computer processing of complex and voluminous weather observations will continue both experimentally and practically to increase the accuracy and the range in time of weather forecasts throughout the world.

The lasers and masers which concentrate light and electronic energy into beams have had an extraordinarily rapid development and their applications to industry as well as scientific research will continue during the year.

Educational Renaissance

As part of the renaissance in educational methods and the continuing improvement in scientific literacy resulting from cooperation of scientists and teachers, there will be increased attention to the kind of education our children receive, the subject material taught and the methods of teaching in all of the school grades from kindergarten to the end of high school.

Because of the better preparation of high school graduates through courses in the new mode, particularly in science, colleges will continue to change their freshman studies to take advantage of the better preparation of their entering students.

The New York World's Fair will present an array of industrial exhibits explaining science and technology to the millions of visitors. The U.S. Atomic Energy Commission will have displays directed particularly to children.

President Kennedy just a month before his assassination told the National Academy of Sciences at its centennial that "the future is bright," that "man is still master of his own fate" and that the future "can be certain." He stressed the need of continuing financial backing for fundamental research in the life sciences, the physical sciences, the social sciences, on natural resources, on agriculture, and on protection against pollution and erosion. He saw science giving mankind a new opportunity for moral discipline as well as intellectual growth. He was convinced that the power of science would strengthen our nerve and will while it added to our knowledge.

In this spirit the great exploration of nature and man pushes on into the future, not just in the next twelve months but for the decades ahead.