1965 Science Review

Detailed highlights of achievements of the year reported and compiled by Science Service as a record of an eventful period in science, research and technology.

By SCIENCE SERVICE STAFF

This summary is limited to highlights, and credit to investigators and institutions is necessarily omitted. If you want more information about any item in the summary, send 25¢ to help cover answering costs for each item upon which more information is requested. Address Science Service, Inc., 1719 N St., N.W., Washington, D.C. 20036.

ANTHROPOLOGY AND ARCHAEOLOGY

New fossil evidences of most ancient life on earth were found in South African rocks dated at about three billion years, while chemical molecules constituting life 2.7 billion years of age were discovered in rocks from Minnesota.

A skull of a different type of human being living about 600,000 years ago was unearthed in the "cradle of civilization," the Olduvai Gorge in Tanzania, East Africa, leading some anthropologists to believe that three different types of prehistoric man existed near each other in this ancient area.

Fossil remains of the world's most ancient human being, found in Olduvai Gorge, Tanzania, may be more than two million years old, it was reported.

The theory of the evolution of Cro-magnon man from Neanderthal was advanced based on the reported discovery of structures of the Neanderthal Age in Russia.

Fossil remains of small clam-like animals were discovered in ancient rocks in the Shaler Mountains on Victoria Island, indicating that small creatures similar to worms and clams may have lived 720 million years ago, 120 million years earlier than heretofore believed.

A more accurate method for determining age, known as fission-track dating, in which the number of tracks caused by spontaneous fission of uranium 238 during the lifetime of a sample is counted, proved successful in dating materials from 20 years to 1.3 billion years old.

An authenticated parchment map drawn in 1440 showing portions of North America, including two large river inlets thought to be the Hudson Straits and the Gulf of St. Lawrence in Canada, added to the evidence that the Norsemen reached North America before Columbus did.

For the first time in North America, bones of a 14-million-year-old paleoparadoxia, a one-ton, nine-foot-long aquatic mammal, were discovered.

During the great ice ages, the Bering Strait area between Russia and North America was sometimes a land bridge for animals and sometimes a seaway for marine creatures, Russian and American scientists agreed.

Ancient man in southeast Europe was found to have switched from hunting and food-gathering to more sophisticated farming about 8,000 years ago, earlier than scientists had previously thought.

The bones of a "new" species of plant-eating dinosaur, 140 million years old, were assembled and named by Chinese paleontologists.

American Indians around Mexico City developed writing and accounting as early as 500 B.C., archaeologists concluded.

Stone Age man controlled his population by means of traditional customs and taboos to remain in balance with his natural world, it was reported.

Two 13,000-year-old skulls, oldest known human remains ever discovered in Egypt, were unearthed in the Kom Ombo area of southern Egypt.

Fine rock paintings of animals and a witch doctor, 20,000 years old, were discovered in a cave near Estoril, Portugal.

Bronze and pottery vessels were unearthed from a 2,700-year-old tomb in Anhwei Province, East China.

Ancient buffalo bones were unearthed for the first time in southern California during construction work for a freeway.

Harvard University

MARBLE GATE—Part of a marble column is shown being lifted into place in the gate of the entrance court to the Roman gymnasium at Sardis, Turkey, which is being restored by the Harvard-Cornell Expedition to Sardis. The court is one of the finest examples of Roman architecture in the Near East.

Scientists began a fossil search in Ohio to dig out 50,000 valuable fish fossils from the Devonian period, more than 350 million years ago.

Fossils of four species of sharks, found at Arad in the heart of Israel's rugged Negev desert, indicated that this area was once covered by a warm sea.

Ancient tools were used to build copies of Iron Age, Viking, medieval and other ancient houses in a new kind of experiment in Denmark.

A new electronic sounding device was used by archaeologists in their hunt for the ancient Greek city of Sybaris in southern Italy.

A fossil skull of a female about 30 years old who lived about 500,000 to 600,000 years ago was reported the most ancient human of the apeman type so far discovered.

Seven isolated teeth led to the identification of two new species of primates, belonging to the new genus *Purgatorius,* that lived 70 million years ago.

A bone plaque, with the design of a griffin twisted in a circle and typical of the "animal style" of the Scythians of South Russia about 2,600 years ago, was discovered in Sardis, Turkey.

More than 180,000 ceramic fragments found in Mexico and Latin America were dated from approximately 1500 B.C., close to the age obtained in an early radiocarbon study of objects found in Florida, adding proof to the theory that Florida was linked long ago to the ancient civilizations of the New World.

ASTRONOMY

The explosively brilliant but maddeningly puzzling objects called quasars, of which some 40 are now known, continued to receive major attention from astronomers around the world; two quasars were reported to have a variable radio output, quasi-stellar blue galaxies were discovered and one quasar was caught in the act of exploding, among other advances.

The quasar known as 3C-9 was found to be the most distant and thus the most ancient object known in the universe today, receding from earth at 149,000 miles a second, 80% of light's speed; however, another explanation of quasars as mass-motion chunks of gas ejected from the Milky Way galaxy and, therefore, much nearer and smaller, was suggested.

A galactic explosion that occurred about 10 million years ago was reported to be the cause of a giant electron ring encircling one end of galaxy M-82, the first evidence of material being ejected from one galaxy to another.

Eight new X-ray sources were discovered, bringing the total to 10, of which three may be neutron stars.

Photographs taken by Mariner 4 revealed that the one percent of the Martian surface photographed is literally sprinkled with craters; radio signals from the planetary probe showed that the atmosphere of Mars is both thinner and cooler than previously thought.

The planet Mercury's rotation rate was

pinned down, first by radar observations and more firmly later by a reanalysis of optical ones, as 58.6 days; even without the physical observations, however, calculations based on mathematical theory showed the same period to be the most likely; Mercury is thus the first observed object in the solar system locked in with respect to its position to the sun in a manner differing from the way the moon is linked to earth.

A new way of studying motions and physical conditions of gaseous nebulae in the Milky Way galaxy by measuring the third known radio emission line of hydrogen was discovered using the new 140-foot radio telescope at the National Radio Astronomy Observatory.

Plans were confirmed for landing on the moon a light-reflecting cube that would bounce a laser beam back to earth, aiding many studies of both lunar and earth constants.

Three cool stars, one with a temperature as low as 800 degrees F., were detected in an infrared search of the sky.

A dark star, the unseen companion in a multiple stellar system, was discovered by observing the changes it causes in the orbits of the two other known members of its stellar system.

A new method for checking on the structure and origin of the universe, based on the scintillations in radio waves from distant objects caused by the solar wind, was used for the first time.

Comet Ikeya-Seki, the brightest visible so far in the 20th century, was a delight to astronomers because it followed very closely the pattern of one in 1882, although disappointing to the general public because it was difficult to see; the nucleus broke into three pieces about two weeks after its Oct. 20 perihelion.

A check on the oblateness of the sun, and thereby whether its gravitational field is distorted or not by measuring the motions of the asteroid Icarus which comes closest to the sun of any minor planet, was proposed as a test of Einstein's general theory of relativity.

Precise computer calculations of the moon's orbit were made, correcting the astronomical time standard by three-tenths of a second.

A space probe will range beyond the planet Jupiter to count cosmic rays in interstellar space within 10 years, it was predicted.

More than 300 "hot spots" on the moon, having temperatures higher than surrounding areas, were detected from infrared scans of the lunar surface during a total solar eclipse.

Radio waves having a polarization of up to 38% were discovered from one radio source, called W-3, believed due to the hydroxyl radical.

The Milky Way galaxy was found to be some 20 billion years old, suggesting that the entire universe is about five billion years older than had been thought.

The planet Pluto was reported to be larger than previously estimated.

A new pattern of huge standing rocks used by Stone Age man to mark the seasons, a Scottish "Stonehenge," was found in Callanish.

Scientists in a jet plane racing along the solar eclipse path over the South Pacific on May 30 observed the blacked-out sun for nearly nine minutes, the longest duration yet.

The youngest natural object in the sky ever discovered, a source of radio waves only 100 years old, was spotted by a Russian astronomer.

Observations showed that the Milky Way galaxy has a more open structure than formerly believed and should be classified as a late spiral rather than as an intermediate system.

BEHAVIORAL SCIENCES

Policemen with racial prejudices can be inspired to do their job without discrimination if given special short-term professional training, a group of sociologists found.

That more Negroes than whites die from high blood pressure can be explained by their inability to obtain the expensive drugs and medical care available to whites, a sociologist said.

Newborn babies recognize and show preference for shapes, indicating that the infant perceptual system is more highly organized than was previously thought, a study revealed.

Suicides by barbiturate poisoning were reported increasing in Britain, and thousands more patients are obtaining barbiturate prescriptions for insomnia, depression and emotional disturbances.

Sharp criticism and punishment at report card time cause less damage to adolescents than parental indifference, a survey of 5,000 high school students indicated.

Morning glory seeds produce hallucinations similar to those of the drug LSD and are being eaten on college campuses, a medical source reported.

The sweaty hands, jumpiness and nightmares of combat fatigue still plague many veterans of World War II, studies showed.

Mass media calmed citizens during the weekend following President John F. Kennedy's death and kept the nation on an even keel amid rumors of a dark conspiracy, a survey showed.

Bachelors were found to show more signs of maladjustment than do single women, with a larger proportion having had disturbed childhoods.

Compressing speech into fractions of its normal time commands more attention and can be a valuable aid to education, psychologists discovered.

Male alcoholics often marry energetic nurse-type wives who enjoy dependent husbands and who get sick themselves if their men stop drinking, it was reported.

A new drug, desipramine, demonstrated impressive success in relieving depression without tranquilizing the patient.

Men seem to respond most readily to pills treating depression while women are best helped with shock therapy, a British study indicated.

Peace Corps volunteers in Ghana performed their jobs with a success that apparently reversed the predictions of psychiatrists, a study suggested.

The human ear can make fine discriminations among object sizes by their echoes, a study of blind individuals demonstrated.

The slight shifting of eyes as animals meet and pass each other is a clue to the non-vocal signals humans flash to communicate emotional states, a study of animal behavior showed.

Psychiatric services were predicted to be at such a level in 10 years that the comprehensive community mental health center will be commonplace and insurance companies will be providing policies for both in- and out-patient treatment.

"Pink spots" found in the urine of a large group of schizophrenics supported the theory that abnormal metabolism is associated with the common mental illness schizophrenia.

"Sensory deprivation," a psychological term referring to low stimulation and apathy, was blamed for many cases of mental retardation, caused by lack of attention during infancy.

Adults who had difficult, harsh childhoods appear to be the most easily hypnotized, a psychologist reported.

Potential delinquents were reported to be most often marked by powers of persuasion and observation beyond their years, coupled with hostile, antipersonal attitudes.

BIOLOGICAL SCIENCES

Collagen molecules, the most abundant proteins in the human body that help strengthen bone, skin and tendons, have three spiral threads wound together to form a helix, scientists found.

The structure of a nucleic acid, carrier of hereditary messages, was determined for the first time.

Bile pigment called chromophore was isolated and identified in a study of the protein molecule called phytochrome, which activates plant growth.

The swelling of one gene on a chromosome sets off a "puff" on another gene, starting the first chain reaction of chemical activity that controls a living cell, a biologist found by observing giant chromosomes of a mosquito-like insect.

The most complex DNA (deoxyribonucleic acid) molecules ever discovered, those in a virus that causes cancer in some rodents, were found to contain double strands of atoms which are joined at the ends.

Scientists were able to bind amino acids together under conditions simulating a wet, primitive earth at room temperature, thus suggesting that life on earth may have begun under these conditions.

Newspapers, magazines, tissues and other paper products in the United States contain a substance showing high juvenile hormone activity for certain insects; this inhibition of normal sexual development, which does not occur when the insects are reared on paper from Europe, could open the way for a new method of insect control.

Studies on protein molecules in the blood of monkeys, tree shrews, lemurs and other primates were made in an effort to understand the evolution of molecules during the last 70 million years.

Twelve new species and some of the

most ancient star-like and thread-like organisms, which may have been living nearly 2,000 million years ago, were found on the Gunflint range of Canada and Minnesota.

Surgery on lamb fetus, which is then allowed to grow normally in the ewe, helped scientists learn about antibodies, tissue transplants and wool growth.

A genetic marker of disease susceptibility was found to link mink, cattle and children.

The iron-containing chemical ferredoxin is one key to the process of photosynthesis, by which plants use sunlight to manufacture their own food, it was reported.

Pellets of the chemical fenuron, when strewn in a forest, were found capable of destroying unwanted older trees and permit valuable seedlings to thrive.

The chemical ethylene, present in plant tissues, acts as a hormone to stimulate fruit to ripen, studies showed.

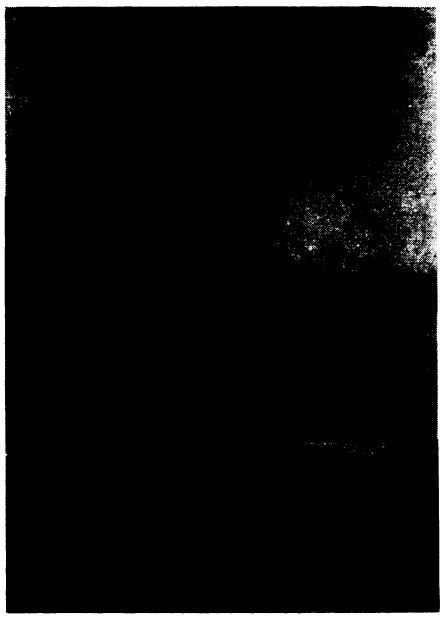
A million-dollar program was undertaken by the United Nations to study the feasibility of releasing sterile Mediterranean fruit flies in Central America in order to suppress infestation there and prevent the spread of the insects to Mexico and the United States.

Domestication of shaggy musk oxen, denizens of cold Arctic regions, was started for the production of wool and food.

The brain of an octopus was found to have two separate memory storehouses, each with four distinct auxiliary lobes.

A pink, eight-legged mite was discovered thriving on a mountain range 309 miles from the South Pole, closer than any other creature yet found.

In a planned program, a painless drug was fed to pigeons in New York City in an effort to cut down egg production and thus reduce the population of the birds.



Humble Oil & Refining Co.

BETSY'S WRATH—The shattered beams of a building brought down by Hurricane Betsy are here contrasted with the calm, sunlit sea off Grand Isle, La. The storm wrecked the town, blowing at least eight feet of water over most of the island.

Scientists worked to crack the code of visual, auditory and tactile gestures that horses, honeybees, gorillas, snails and many other animals use to communicate with one another.

Memory may involve the rapid production of highly specialized proteins in the brain as they respond to alterations in the internal environment, scientists found.

A new technique for identifying plants using two-dimensional paper chromatography to take patterns of extracts from plants was developed.

Rats at cold temperatures continue to function better than those subjected to hot temperatures, scientists found.

Polar bears are slowly evolving into a sea animal, it was reported.

A tiny parasitic ant thriving in South America was being studied as a potential control for the imported fire ant in the southern United States.

Satellites were forecast to be of invaluable aid to agriculture by recording strips of crops 50 to 100 miles wide to check on growth and prevalence of insects, weeds or diseases, scientists said.

Catnip was found to attract cats and other felines but repel certain insects.

Wild African hunting dogs keep order in the pack by making the weaker members crawl and beg for food, animal behaviorists reported.

A new kind of black fish with orange spots, named *Kasidoron edom,* was discovered off the coast of Florida.

Yellow fever mosquitoes were attracted to men more than to women, and to persons with high skin temperature, entomologists found.

Scientists continued their search to find out why thousands of honeybee colonies are disappearing or dying since the bees' deaths are not caused by insecticides, poisons, diseases or climatic conditions.

Scientists were able to change the fur of a weasel from brown to white by removing the pituitary gland of the animal.

Sea lions use eyes by day to detect underwater objects, but emit clicks as radar to find their way by night, scientists found.

An atom-powered heart run by a four and a half pound atomic steam engine implanted in the abdomen and a transistorized ear that will produce intelligible sound through direct contact with a brain nerve were under development.

A greatly miniaturized heart pacemaker that weighs only 1.8 ounces and can be implanted in a child's abdomen was developed.

The use of radioactive technetium 99 in a new scanning technique for examining organs of the body reduced the radiation danger to a patient to virtually nothing since exposure of less than a minute is required and radiation does not linger in the body.

A possible method of birth control was studied with a water extract of the gray millet plant used by Shoshone Indian squaws in Nevada to suppress ovulation.

An instrument called an endotoscope was under development to enable physicians to examine the middle ear visually with little discomfort to the patient.

A yellow-seeded soybean, resistant to the soybean cyst nematode, was made available to farmers.

An angora mouse with long hair, a recessive mutation, appeared among hundreds of thousands of inbred mice in Jackson Laboratory, Bar Harbor, Maine.

Termites cannot withstand extremes of hot or cold temperatures, scientists found.

In a study of photosynthesis, flashing laser light was used to show that it takes chlorophyll from purple sulfur bacteria two-millionths of a second to pass laser energy onto an enzyme.

The Yerkes Regional Primate Research Center on the Emory University Campus at Atlanta, Ga., considered to have the most valuable collection of non-human primates in the world, was dedicated.

Chemical compounds of biological origin were definitely found and identified in meteorites, and studies were in progress to determine their origins.

A new antibiotic, anthelvencin, was found to be successful in ridding swine of whipworm.

Microorganisms 700 million to 900 million years old that may represent a transition period in the evolution of plant life were discovered in well-preserved condition in central Australia.

CHEMISTRY AND PHYSICS

A new theory called SU-6, that greatly extends knowledge of nuclear particles, demonstrates an underlying unity among the known families of particles, predicts the existence of new particles and offers considerable insight into how they interact with each other in the nucleus and in experimental situations, was reported.

Evidence for the possible existence of an antiworld, antigalaxies or antiuniverse was strengthened with the discovery of the antideuteron, the largest known particle of antimatter and the first known antinucleus made up of more than one antinucleon.

A confirming experiment using the CERN accelerator in Geneva showed that time has only one direction of flow under certain conditions and proved the non-existence of the fifth force, indicating that the symmetry law known as "CP invariance" does not always apply in the world of the atomic nucleus.

The discovery of two different kinds of naturally occuring neutrinos, reported independently within two weeks of each other by the same scientists who first detected man-made neutrinos, was predicted to open a new chapter in man's studies of this elusive subatomic particle.

Synthetic metals were created from nonmetals by using high pressures.

As predicted in theory, but not previously observed, protons and neutrons were found to exert weakly interacting forces, as well as strong forces.

The five nucleotides that make up deoxyribonucleic acid, DNA, and ribonucleic acid, RNA, were synthesized, using only a simple phosphate added to ammonia, methane and water.

Lawrence Radiation Laboratory at the University of California drew plans for a 200 billion electron volt circulator proton

accelerator and the U.S. Atomic Energy Commission outlined criteria for the site.

It was suggested that a chunk of antimatter smashing into the earth's high atmosphere may have caused the huge explosion over Siberia in 1908.

Perlithiopropyne, a new chemical compound with all four hydrogen atoms replaced by lithium atoms, that could lead to improved rubber for car tires and plastics, was produced.

A new theory of how molecules stick to surfaces of solids, actually a resurrection of an old theory that molecules are held to electrically charged surfaces by unbalanced electrical fields, was proposed.

A giant computer system for storing the structures of all the known chemicals to make it possible for chemists to do instant chemical research was under development.

A new family of plastics that has the ability to conduct electricity with possible use in printed circuits was reported under investigation.

Three physicists, Dr. Richard P. Feynman of California Institute of Technology, Dr. Julian Schwinger of Harvard University and Dr. Sin-Itiro Tomonaga of Tokyo, Japan, were awarded the Nobel Prize in Physics.

Dr. Robert B. Woodward of Harvard University was awarded the Nobel Prize in Chemistry.

A laser beam two miles long was reduced to a 10-foot-long space between two mirrors.

A new test was proposed to check Einstein's general theory of relativity by measuring the time delay caused by the sun's gravitational field affecting radar waves reflected from Mercury or Venus.

A new theory of the structure of atomic nuclei, based on the concept of tightly packaged aggregates of protons and neutrons called "spherons," was proposed.

The existence of the photon echo—an intense burst of radiation from a ruby crystal that has previously been subjected to two short, intense light pulses from a ruby laser—was established, promising wide application in solid state physics and computer work.

A new mass spectrograph technique for sorting atoms was predicted to be especially valuable in the analysis of organic molecules, such as deoxyribonucleic acid.

To combat the silver shortage, silverless coins consisting of 75% copper and 25% nickel alloy sandwiched around a pure copper core were issued.

A method of extracting oxygen from rocks, that may have applications for providing oxygen for those landing on the moon, was devised.

Carbon dioxide exhaled by four persons in a spacecraft test cabin was successfully broken down into breathable oxygen for reuse.

Polystyrene was produced from monomer styrene by irradiation with light from a pulsed ruby laser.

The basic structure of the saccharin molecule, consisting of a six-atom ring and a flat five-atom ring joined together, was determined.

Cyanamide dimer, a simple chemical compound that could have been formed on earth long before life as it is now known evolved, was created in the laboratory.

A new technique for measuring neutron interactions, using a vertical vacuum pipe that transmits the neutrons from an underground nuclear detonation, was developed.

A 30-foot-long accelerator, capable of firing a whole molecule at an atomic target, was devised to help chemists learn the secrets of molecular collisions.

The intense light of the laser beam was used to generate hypersonic vibrations as high as 60,000 million cycles a second for studying structure of matter.

New data on cold welding, the tendency of metals to adhere to each other in space vacuum environments, indicated that the phenomenon could be possibly used as a method of building structures on the moon or in space.

Cyclobutadiene, the existence of which had been considered theoretically possible since before the turn of the century, was produced for the first time.

Superconductivity was discovered in compounds of graphite and alkali metals, the first such discovery in graphite compounds.

It was discovered that the amount of current from a conventional battery could be tripled by a simple change in design.

The computer was reported to have been incorporated as a part of nuclear experiments to scan atomic debris in several accelerators, and to obtain information, analyze results and supervise photographing the events.

New polymers that contain both aromatic and heterocyclic rings were synthesized and shown to have great promise for use as spacecraft materials.

The first laser pumped by the energy of a chemical reaction was successfully operated.

Two lasers were locked together in phase for the first time, a step making it possible to divide in half the transmitted power in experimental light communications systems.

A coaxial cable system was developed that can transmit 32,400 conversations over one cable, nearly twice the capacity of any long-distance system in commercial use.

Beta tantalum, an improved form of tantalum, was discovered and is expected to prove useful for making capacitors for electronic thin-film circuits.

A new class of richly colored organic compounds was produced in which one, two and even three extra electrons were added.

Sinoite, an extraterrestrial mineral previously unknown on earth, was discovered in a meteorite that fell in Pakistan in 1926.

Building of an electron synchrotron about one-half mile in circumference by Cornell University, which will be the world's largest of this type, was authorized.

A two-mile 20 billion electron volt linear accelerator for electrons, the largest in the world, was 60% completed at Stanford University in California.

A new substance made of polyethylene plastic and butadiene that combines the hardness of plastic and the springiness of rubber was developed.

The Hope Diamond was found to glow with a red light after illumination by ultraviolet light, unlike other diamonds which give off a light blue light when similarly treated.

A technique tracing the carbon 14 due to fallout present in various tissues of man and animal was predicted to give scientists a new and simple way of studying the formation and decay of tissues and cells.

A laser beam was successfully used to receive and relay signals from seven television channels simultaneously, carrying both picture and sound.

A specialized laser spectrometer was developed that can test properties of liquids previously thought either too slow, too ephemeral or too small to be probed.

Radio static from outer space was found useful for checking the sensitivity of the receivers of the Distant Early Warning line, a chain of radar and communication stations protecting the northern boundaries of North America.

Electrical power generating units in which methanol or wood alcohol is the chief liquid fuel were reported as technically possible now.

Studies continued on the possible uses of the new organic molecule cubane, which was synthesized in 1964.

CONSERVATION

Continuing research showed that pollutants issuing from incompletely burned exhaust fumes of vehicles are increasing to dangerous proportions, and stronger controls were urged if the automotive industry does not take necessary action to reduce pollutants.

Drastic measures were taken to save the whales from extinction by an agreement of the 14-nation International Whaling Commission to observe the quota of whales to be killed each year.

In man's effort to combat destructive insects without using poisons harmful to other life, scientists continued to use and to perfect a variety of weapons including black light, infrared radiation, sexual attractants, sterility and insect-attacking disease organisms.

Scientists and statesmen considered economic assets of developing wildlife ranches and game preserves to raise elephants, hippopotamuses, deer and other wild animals for commercially supplying food to the world's growing population.

Municipalities throughout the nation were reported having made more definite gains on cleaning up rivers and streams than private industry, which is spending only some $100 million each year on research and equipment for anti-pollution measures.

Migrating flocks of valuable waterbirds including ducks and geese continued to be preserved mainly because they were able to find food and rest on private lands and farms throughout the nation.

A breed of bacteria that consumes chemically combined oxygen in waste without air was cultivated to fight pollution of waste water.

In an effort to increase the nation's water supply, a plan was proposed to channel surplus waters from Alaska and northwest Canada through canals, mountain tunnels and streams.

Continued studies showed that floods can be moderated by such measures as contour plowing, planting of shrubs and other plants to hold water in the soil, using a series of water storage and dams, and by careful zoning of the land followed by location of communities in non-flood zones.

Low-volume spraying of pure insecticides, using less than a cup of spray per acre, was found to control pests.

The 89th Congress was one of the most productive on record in the conservation area, enacting on highly significant bills concerning water and air pollution control, water resources, establishment of outdoor recreation areas, wildlife management and highway beautification.

Zoological parks, museums and game farms throughout the world developed new materials and methods to exhibit wild animals and birds and save them from extinction.

Farmers and landowners took better care of wildlife on their land to supplement their income and increase the nation's recreation.

EARTH SCIENCES

For the fifth year in a row, the northeastern United States remained in a drought condition that threatens the water supply of many cities and is speeding up steps to prevent water wastage and to obtain fresh water by desalting methods; disastrous droughts were reported in other parts of the world, including Spain, Africa and South Korea.

Measurements from satellites showed that the earth has four high points, each covering several thousand square miles, that are 220 feet higher than they would be if the earth were exactly spherical.

A map contoured to show strain in the earth's crust was drawn to help scientists judge more accurately where earthquakes are likely to occur.

A new agency called the Environmental Science Services Administration (ESSA) was created by a merger of the U.S. Weather Bureau, the U.S. Coast and Geodetic Survey and the radio propagation groups of the National Bureau of Standards.

The National Science Foundation awarded a $30 million contract to a San Diego shipbuilding firm for construction of a gigantic ocean-going drilling platform that will be used in Project Mohole, a massive engineering and scientific attempt to bore a hole through the earth's crust and into its mantle at a site north of the Hawaiian Islands.

Some 40 nations joined to collaborate in the Upper Mantle Project, which will reach its peak activity in the next two years.

Parts of the eastern Indian Ocean floor may have sunk as much as a mile since the bottom rocks were formed some 30 million years ago, examination of rocks dredged up as part of the Indian Ocean Expedition indicated.

The flood waters of the Mississippi River in April this year were the highest on record.

Photographs taken with infrared light mounted on airplanes were found to be a new method of locating fresh water.

A 25-mile-wide valley stretches 600 miles under the Andaman Sea in the Indian Ocean, scientists exploring for the International Indian Ocean Expedition discovered.

By 1980, benefits worth six billion dollars a year could be pulled from the ocean in forms of edible plants and animals, minerals and chemicals, a panel of scientists organized by the National Academy of Sciences predicted.

A method was developed for scanning the ocean floor 8,000 feet deep with an ultrasonic camera that sends out sound waves and picks up their echoes.

The first stable deep-sea structure, nicknamed Sea Spider, was installed in half-mile deep water off the South Carolina coast to record such oceanographic data as temperatures, currents and underwater sounds.

A National Center for Earthquake Research was established by the U.S. Geological Survey at Menlo Park, Calif.

The International Hydrological Decade (IHD) was launched to gain more facts about the world's water supply from such projects as making inventories of ice and snow, measuring glaciers, and studying factors of drought and saltwater areas.

Giant underwater landslides, rising thousands of feet above the ocean floor, were discovered near the Hawaiian Islands.

Underground nuclear explosions in the Rocky Mountain region could increase total natural gas production about seven times above today's levels, a study showed.

Phosphate pebbles were discovered in holes drilled in the continental shelf off the coast of Georgia and northern Florida in operations conducted by the Joint Oceanographic Institutions' Deep Earth Sampling (JOIDES).

A new deep-sea sounding system, called narrow-beam transducer sounding, provided more accurate measurements of the ocean floor than previously obtained.

Mining, squeezing, pushing and sucking techniques were predicted as the methods to be used to recover by 1980 about half of the U.S. petroleum supply from wells now considered dry.

A series of controlled chemical explosions were set off from various spots of the Colorado Rocky Mountains to the southeast Coastal Plains to learn more about what lies under the land's surface.

The Gulf Stream was subjected to close, carefully planned study by scientists from various Federal bureaus, universities and institutions.

A sensitive seismograph was placed more than two miles under the Pacific Ocean off the California shore to record vibrations of earthquakes and possible nuclear explosions.

A natural earth satellite, which existed only briefly, collided with earth nearly 6,000 years ago, evidence from meteorite craters in northern Argentina suggested.

All of earth's continents may be the remains of swarms of huge meteors that struck the earth billions of years ago, several geologists suggested.

Tiny round and elliptical forms that may have been living 600 million years ago were found in the black shales of the Labrador Trough, Quebec.

The materials of the earth's mantle are a combination of solid, liquid and gas, a state of matter called "soliqueous," it was reported, and plastic rupture in shear was suggested as the primary mechanism by which energy is converted to earthquakes.

The earth may originally have formed two supercontinents, Laurasia and Gondwana, which may later have split up into smaller land masses drifting to form present continents, scientists suggested.

A program for studying earthquakes and setting up warning systems and methods for reducing death tolls from quakes, estimated to take ten years and cost $137 million, was proposed by a panel set up by President Johnson's Office of Science and Technology.

U.S. oceanographers penetrated 1,050 feet beneath the Atlantic Ocean floor off the coast of Florida, the deepest drill known, to bring up core samples 40 million years old.

Rocket tests confirmed that 80% of the twinkling of starlight occurs in a layer of the earth's atmosphere about the altitude of the tropopause.

Photographs taken from Gemini 5 demonstrated for the first time that airglow, a diffuse atmospheric light, occurs in a layer about 12 miles thick at an altitude of about 57 miles.

Remains of an inland sea that existed about 350 million years ago, now a large salt bed, were discovered in Queensland, Australia.

Rainfall and snowfall seem to be heavier than usual during the week following a new moon and a full moon, scientists found, which suggests a linkage between the earth's precipitation and the moon's phases.

The Antarctic coastline is 18,648 miles long, Soviet Union geographers calculated, about 1,000 more miles than had been previously estimated.

A new method of telling the ages of rocks that involves measuring the amount of amino acids found in the rock was developed.

It was found that tornadoes can funnel higher than average levels of radioactivity from the upper atmosphere to form "hot spots" on the ground.

More than 3,000 holes were dug in the Atlantic Ocean off South Africa in an attempt to map diamond deposits.

Radar was tested as a method of charting the ground that lies beneath the Antarctic icecap.

An unexpected layer of oxygen atoms was discovered 720 miles above the earth's surface where the atmosphere is mostly hydrogen.

Plans were made to float free-flying balloons around the world in the Southern Hemisphere for about 60 days at different altitudes in an effort to gain weather information from inaccessible locations.

A sensitive listening station was set up in Israel by the U.S. National Bureau of Standards to study very low-pitched atmospheric sounds.

Hurricane Betsy, taking an erratic course during which it slammed into the U.S. mainland two nights in early September, was one of the most destructive in all history.

New emphasis on studies of the earth from surface to core, with particular attention to the mantle that extends some 2,000 miles below the crust, was urged by a panel of the National Academy of Sciences.

Detailed charts of the surface currents of the Atlantic Ocean along the coasts from Newfoundland to Florida were made from a 14-year study.

Measurements showed that Arabia has been drifting away from Africa for more than 20 million years—its present rate of drift being two centimeters each year.

In an effort to test man's ability to live for extended periods of time in a hostile environment, Astronaut M. Scott Carpenter and other teams of men remained in an underwater Sealab for periods up to 45 days off the coast of California.

Rainwater 40,000 years old was found in saturated layers about 1,500 feet beneath the desert in Saudi Arabia, a country with no permanent water courses.

Photographs of the ocean bottom showed that the mysterious, spirally coiled tracks along the ocean floor were made by the "giant" enteropneust, or acorn worm.

Taal volcano in the Philippines, which had remained quiet on the surface since 1911, erupted on Sept. 28.

A new tool for geologists that uses a beam of light or radio waves to measure the diameter of a volcano's crater as it expands or contracts was devised.

ENGINEERING AND TECHNOLOGY

The greatest blackout in history, a power failure that darkened most of the Northeast including the city of New York, was blamed on a Canadian relay that erroneously tripped a circuit breaker, cascading into a backward surge of 1.2 million kilowatts of power that in quick succession overloaded and shut down interlocking U.S. circuits.

See Front Cover

The X-15 rocket plane tried out a set of new external fuel tanks in November, reached 1,432 mph and 71,000 feet (best flights of the year, without the new tanks, produced 3,938 mph and 300,000 feet, still substantially below the plane's possible records).

A plant using reverse osmosis for converting brackish water into fresh water was established in Coalinga, Calif., making it the first town in the world to put such a unit into daily use.

A new equation was devised that tells engineers for the first time exactly how far certain kinds of stresses can penetrate into structural members.

A jet-powered airplane that could dive into an ocean and cruise underwater as a submarine was designed.

Development of a new three-cell battery, powered by microorganisms that live on coconut juice, and capable of running a transistor radio, was reported.

Tests showed that automobile exhaust gases could be converted into emergency drinking water.

Radial-ply tires, standard in Europe for many years, made their debut in the United States.

The so-called Boston-Washington corridor was selected as a testing area for the high-speed commuter rail transit program that received the support of President Lyndon B. Johnson in his State of the Union address.

A new method for coding radio waves called DM for digital modulation was tested.

To protect the eyes against flashblindness and permanent eye damage from explosions, goggles were developed that can shut off the flash from a nuclear explosion faster than the human eye can react to it.

The tell-tale hair shed by most persons wherever they go was shown to have promise as a new and better weapon than the fingerprint system to detect criminals.

A pasty substance that will repel rain when rubbed on the windshield was developed to provide better vision to automobile drivers and aircraft pilots during rainstorms and thus help prevent accidents.

Materials small enough to be carried in the pocket were found sufficient to construct a solar still that will produce water from dry desert soil.

The newly formed National Academy of Engineering brought its membership to 70 persons, selected in recognition of important contributions to engineering theory and practice or to the pioneering of new and developing fields of technology.

A centrifuge system that separates blood components on the basis of differing densities and allows collection of a high percentage of white blood cells was developed.

A computer that actually synthesizes sounds and can both talk and sing was demonstrated.

Development of computers that can read electrocardiograms in 15 seconds indicated the possibility of mass produced "heart wagons" similar to current mobile chest X-ray units.

Sodium vapor electric lamps that produce 50% more light and last longer than mercury vapor tubes or the usual household light bulb were developed.

Scientists found that a gamma-ray source can be used to "mark" a column of air so that its movements can be detected by radar.

A new way for cleaning sulfur mined from the earth by the Frasch process was devised.

The use of nuclear explosives for digging canals or excavating mountain roads, although economical, raised the question of biological risk and violation of the Test Ban Treaty.

A first step toward making a completely artificial nerve cell was made with the development of the neuristor, a tiny wire along which an electrical impulse can travel one inch in less than one-millionth of a second.

A new image-forming device that makes use of diffraction optics and uses no lens was developed, making possible the production of cheaper microscopes, telescopes, space optics and laser optical systems.

A surgical drill that runs by compressed air and can cut through bone and cartilage as easily as a surgeon's knife slices through tissue was introduced as a part of a new concept in surgery called air surgery.

Possibilities for military use were seen in a boat designed to run by solar power.

Synthetic seaweed, made from strong polypropylene fibers, having the same effect as natural seaweed in absorbing wave energy, were used in experiments to check erosion and build up beaches.

The U.S. Air Force fighter and interceptor, YF-12A, achieved distinction as the fastest plane in the world.

A special computer technique was devised to make possible repeated rapid checks of the effects of the U.S. hydrogen bomb exploded over the Pacific Ocean more than three years ago.

An automatic irrigation system that is activated by radio transmissions beamed from a farmhouse and will save time, labor and water was successfully tested.

A one-half-inch magnetic rod made of yttrium iron garnet that combines in one tiny unit both signal delay and amplification, and is expected to lead to simpler, cheaper and more efficient radar systems was developed.

A scale of temperature, based on the acoustical thermometer was established for the region between 4 and 14 degrees Kelvin (minus 269 and minus 259 degrees C.).

The laser was successfully applied to the accurate measurement of length.

Development of a special technique for purification by freezing promised to make possible degrees of ultrapurity never before attained.

Preliminary tests were made on a self-correcting radio receiver that could automatically eliminate static, blackouts or other atmospheric disturbances.

A device that flashes a predetermined code enabling totally deaf persons to communicate by telephone was developed.

Claims were made that the function of a nerve cell was re-created in a device that makes decisions and seeks new ways to improve performance.

A compact unit that will make possible navigating small ships by satellite signal was designed.

A speech analyzer that eventually could make it possible to carry more than 1,000 conversations over a system where only one conversation is now being carried was offered as a solution to meet the needs of the increasingly congested channels of communication.

A new technique that senses the changes in the electrostatic field caused by the motion of a spacecraft or jet plane was tested and could possibly be used for space vehicles to detect one another in space.

An image tube camera that can take a hundred million pictures per second was developed.

Satellites that transmit radio and television directly into homes without the use of ground stations was predicted.

A winged research helicopter that uses a rigid-rotor system reached a speed of 259 miles per hour, the world's fastest rotorcraft speed to date.

A bed that floats on water developed to simulate weightlessness for manned space flight research was reported adaptable for use by hospital patients.

Early detection of the presence of bone disease became a possibility by the develop-

ment of an acoustical technique that determines the density of the ulna, an arm bone.

GENERAL SCIENCE

A greatly expanded role for the National Science Foundation in the Federal support of basic scientific research to enable it to balance out the variable support of mission-oriented agencies and provide for orderly growth of fundamental science was recommended in a report to Congress by the National Academy of Sciences.

The 1965 Higher Education Act, passed by Congress on Oct. 20, provided a broad program of financial aid to colleges and college students, the first legislation to lay major emphasis on helping the undergraduate student and on the problems created for undergraduate colleges by the rising aspirations of young persons from all income levels.

The 20th anniversary of the dropping of the atomic bomb finds man no closer to answering the extremely vital question of whether this new power will ultimately be used wisely for the benefit of mankind or selfishly for destruction.

To prevent duplication of research, a clearing house to provide scientists with up-to-date information on titles and authors of technical articles accepted for publication by various journals was proposed in the United States, while in England, a new office to deal with the problems of international information explosion in science and technology was established.

The International Years of the Quiet Sun, or IQSY, ended in 1965, with the sun having remained at a low level of activity as expected, scientists involved in the world-wide program made plans to continue coordination of interdisciplinary projects in the post-IQSY period.

The Smithsonian Institution observed its founder's 200th birthday with ceremonies attended by some 500 world scholars and scientists.

A new philosophy of international relations, built on the concept that neither capitalism nor communism will conquer the world, was offered as a solution to peaceful coexistence and the problems inherent with the continuing increase in population.

A change in the method of running international science congresses, which have become so large they no longer serve the original purpose of exchanging scientific information, was proposed.

The oldest and most complete naval remnant of the Revolutionary War, the 55-foot long ship Philadelphia, was recovered from Lake Champlain almost intact and with all her armament.

Time Capsule II, containing 117,000 microfilmed pages that document the major achievements and events of the past quarter century and also 45 objects selected for their significance 5,000 years from now, was lowered into its 50-foot steel shaft on the grounds of the New York World's Fair.

A new concept of education called learning by teaching was urged as a powerful method of educating youngsters, teen-agers and adults at the White House Conference on Education.

The dominant role of the Federal Government in the U.S. research and development effort was seen as a potential threat to the proper economic growth of the country by the Chamber of Commerce of the United States, which suggested that more support be sought from private sources.

President Lyndon B. Johnson disclosed plans to develop a new submarine missile system called the Poseidon to provide added protection against enemy attack.

The evaluation of educational performance was singled out as one of the "tough issues" debated by participants at the White House Conference on Education.

Pope Paul VI visited the United States on a mission of peace.

Dr. Frederick Seitz, who earlier had been reelected for a six-year term as full-time president of the National Academy of Sciences, was the recipient of the 1965 Franklin Medal in late fall.

Dr. Warren Weaver received the first Arches of Science Award of the Pacific Science Center Foundation, an award characterized as "an American Nobel Prize."

The Army, Navy and Air Force will be combined into one huge military service within the next 20 years, it was predicted.

It was proposed that the icy regions of the North Pole be declared a nuclear-free zone.

The increasing number of accidents resulting from the growth of basement rocket building prompted the American Institute of Aeronautics and Astronautics to request new laws to prohibit unauthorized rocket building.

The 44-letter Initial Teaching Alphabet devised in England to teach children reading was proved successful and is being used in all first grades in Bethlehem, Pa.

The new center for health and medicine of the Pan American Health Organization and the World Health Organization, located near the Lincoln Memorial in Washington D.C., was dedicated.

Designs for the Smithsonian Institution's National Air and Space Museum, to be located on the Washington Mall and the largest of its kind in the world, were unveiled.

More money and increased effort in all fields of chemistry, bringing the total per year to $120 million by 1968, was urged in a report by a special survey panel of the National Academy of Sciences.

The Science Talent Search for Westinghouse Science Scholarships and Awards celebrated its 25th anniversary.

The life expectancy for the average white male born in 1960 is 75.5 years, 37 years greater than if he had been born in 1840, it was reported.

The number of bachelor's degrees granted by U.S. colleges in 1975 will be some 815,000, almost twice the current total, the U.S. Office of Education of the Department of Health, Education and Welfare estimated.

Suggestions for the prevention of an increasing number of automobile accidents and resulting injuries and death included a seat belt designed to provide restraint in the upper part of the body as well as in the lower to prevent forward flexion; electronically controlled highways to regulate speed and traffic flow; small trees planted on center strips of expressways to shield the light of oncoming cars and also to break the monotony of driving, and bright red triangular emblems on the back of slow-moving vehicles to prevent back-end collisions.

MEDICINE

The Medicare bill making Social Security responsible for hospital payments for most 65-year-old persons was signed into law July 30, 1965, by President Lyndon B. Johnson in Independence, Mo., so that former President Harry S. Truman, the first President to send a legislative message to Congress (Nov. 19, 1945) on the nation's health needs, could witness the ceremony.

Legislation for a heart disease, cancer and stroke program was passed that will create a network of at least 32 complexes throughout the United States, thus coordinating research, treatment and administration procedures.

Cancer cells were transmitted by the *Aedes aegypti* mosquito between hamsters, it was proved for the first time in experiments.

Prevention of cancer spread by interference with blood clotting through such anticoagulants as heparin or dicoumarol was reported as an "exciting" possibility.

Ultrasound was found to aid in diagnosis of heart disease.

The Rh factor danger in second births was seen on the way out by giving the mother high-antibody gamma globulin within a few hours after the birth of her first baby.

Cancerous tumor masses were reported to shrink more than 50% after treatment with the antibiotic mithramycin.

A hot-blade scalpel that would prevent bleeding by sealing tissues when they are cut was reported under development.

Life units of mice and men were fused experimentally in test tubes by mixing certain cells of the two species together with a virus.

Virus particles identical in structure to those of a common African childhood cancer, Burkitt's lymphoma, were found in one 27-year-old U.S. female.

The powerful antibiotic drug streptomycin was accused of causing ear damage to the unborn child when given to pregnant women.

An artificial heart was partially implanted in a calf's heart cavity, leading to predictions that a complete substitute heart could be pumping inside a human chest within five years.

Skin cancer and precancerous tumors associated with chronic sunburn were treated successfully by direct application of anti-tumor drugs normally used for internal cancer therapy.

Blackwater fever, a severely toxic complication of malaria, was reported unofficially as attacking U.S. troops in Viet Nam.

The billion-dollar program of the Government's National Institutes of Health, Bethesda, Md., was said to be financially justified but received constructive criticism in the so-called Wooldridge report, named after the chairman of the study committee of 13 persons with almost 1,000 persons cooperating.

Thalidomide, the drug that caused many deformed babies when taken by pregnant women as a sedative, was shown to prolong the "take" of skin grafts in mice, indicating it may have an immunosuppressive action.

Complete remissions for long periods in some adult leukemia patients were produced by intensive combination therapy, using the known anticancer drugs methotrexate, 6-mercaptopurine, prednisone and vincristine.

A requirement for a health warning on cigarette labels was passed by Congress but denounced as meaningless because general advertising is allowed to continue.

Calf bone material, including cartilage, was approved under the trade name Boplant by the U.S. Government for transplantation into humans, and was made available to surgeons and hospitals for the more than 700,000 bone transplants performed each year in the United States.

Suppression of intestinal bacteria was reported to aid recovery in seriously burned animals.

Test tube synthesis of a self-propagating infectious virus was accomplished.

A high-pressure oxygen chamber provided a favorable climate for later radiation treatment of some types of cancer, the total time in the tank being less than 30 minutes.

Warning was sounded of the danger of cancer from plastics, imbedded under the skin of women's breasts and other parts of the human anatomy for cosmetic reasons.

A new cystic fibrosis diagnosis was reported through analysis of sodium in fingernail and toenail clippings, making preliminary diagnosis easier than the customary "sweat test" based on electrolyte concentration in the sweat.

A Registry of Tissue Reaction to Drugs, to be located at the Armed Forces Institute of Pathology, Washington, D.C., gained the cooperation of the American Medical Association, the Pharmaceutical Manufacturers Association and the U.S. Food and Drug Administration.

The antibiotic called Lincocin, reported to have a unique chemical structure making it effective against many bacteria that resist other antibiotics, was made available to U.S. physicians.

The first case of cholera in the United States in 54 years was reported after the recovery of a laboratory technician in Washington, D.C., who had been using *Vibrio cholerae* in an experiment.

A new form of the tranquilizer Prolixin that will keep mental patients quiet and cooperative on one injection every 10 to 20 days, was announced by a team of researchers.

Several adenoviruses, which cause respiratory diseases in children, caused cancerous tumors in hamsters.

The laser was used to destroy tumor implants in animal systems; chemotherapy was found to increase the destructive effect of laser energy in tumor-bearing mice.

A major medical advance was seen in an experimental vaccine that appears to be effective against pneumonia caused by one of the mycoplasma germs, a class of microbes that has also been linked recently with arthritis.

Aflatoxin, a substance produced in moldy peanuts by the mold *Aspergillus flavus,* not only caused liver cancer in animals but also caused breaks in human chromosomes.

The report of a naturally acquired malaria in man transferable to monkeys was the first proof that Simian malaria is a true zoonosis.

Virtually completed synthesis of human insulin, up to the final joining of the two chains of amino acids that comprise molecular insulin, was reported.

Avoidance of leg amputation was achieved by using two new techniques to unite a shin bone fracture that previously would not heal because of infection.

Checkups for cancer inside the womb using a painless fluorometric test as well as the popular PAP smear, was advocated.

Liver cancer was induced in monkeys for the first time by DENA, or N-nitrosodiethylamine, administered by mouth or by abdominal injection.

Dog brains were successfully transplanted for the first time in medical history, opening the way to further research that could lead to treatment of brain tumors, cancerous growths and a better knowledge of some of the causes and treatment of multiple sclerosis.

Three drugs containing meclizine, cyclizine and chlorcyclizine were ordered labeled with a warning to pregnant women, or women who may become pregnant, of the danger to an unborn child in using them.

Human grafts of the outermost coat of the eyeball corrected or prevented failing sight due to retinal detachment, rupture of the eye and drooping of the eyelid, paving the way for establishment of sclera banks.

Burn patients have a better chance of survival as a result of new treatment either by silver nitrate or by a cream, called sulfamylon, placed on the burned area immediately after the cleansing of the burn wound, it was reported.

Synthetic skin tested successfully in treating burns on pigs and rabbits was reported ready for trial on human beings.

A strong link between color blindness, a sex-linked genetic characteristic, and cirrhosis of the liver, commonly associated with alcoholism, was seen as a possible tool for studying diseases with a common genetic link.

Thyroid nodules were found in 70 school children between the ages of 10 and 18 in Washington County, Utah, within the fallout area of the Nevada Nuclear Test Site in the 1950s, and in 25 children of the same age in Graham County, Ariz., outside the fallout area, a discovery that could indicate malignancy in some cases.

A new diagnostic test for the German measles virus, called the hemadsorption-negative plaque test, cut by two-thirds the usual time for virus identification and simplified the method so that any laboratory equipped for virus procedures can use it.

A team of surgeons reported a technique in which gas blown through the diseased segment of an artery of a patient suffering from atherosclerosis clears away fat which has accumulated in them.

Excessive amounts of the enzyme creatine phosphokinase occur in victims of muscular dystrophy, scientists found, which can serve as a means for helping to detect this disease.

President Lyndon B. Johnson underwent successful surgery for removal of his gallbladder and a kidney stone in the ureter.

Unburned cigarette tobacco was found to contain material that caused tumors in experimental mice.

The malignant tumor of the retina called retinoblastoma was reported cured in 85% to 90% of cases that are discovered early and treated by combinations of X-ray and drugs.

A new class of anesthetic and pain-killing compounds, more powerful than the hitherto basic animal anesthetic meperidine, was developed.

Treadmill exercise of chickens fed on high-cholesterol diets prevented them from developing atherosclerosis.

The leprosy bacillus *Mycobacterium leprae* was grown in tissue culture, thus breaking one of the last barriers to faster development of anti-leprosy drugs or preventive agents.

A successful breast cancer vaccine was reported having been prepared in Moscow from killed cancer cells at the time of surgery.

The Nobel Prize in Physiology or Medicine was shared by three French scientists associated with the Pasteur Institute, Prof. A. Andre Lwoff, Francois Jacob and Jacques Monod.

PATENTS

The United States was urged to take the leadership in creating an international patent system, a necessity in the world of tomorrow, under which only one patent would be issued for each invention.

Inventions patented during the past year include:

A new and promising method for using very thin layers of silver halide for photographic film and techniques for transferring the images made possible by the film. Patents 3,219,444, 3,219,445 and 3,219,448 through 3,219,452.

A process for making plutonium, a major ingredient in both A and H bombs, granted 24 years after its discovery. Patent 3,190,804.

An artificial heart making use of the principle of fluid amplification in which no mechanically moving parts are necessary. Patent 3,208,448.

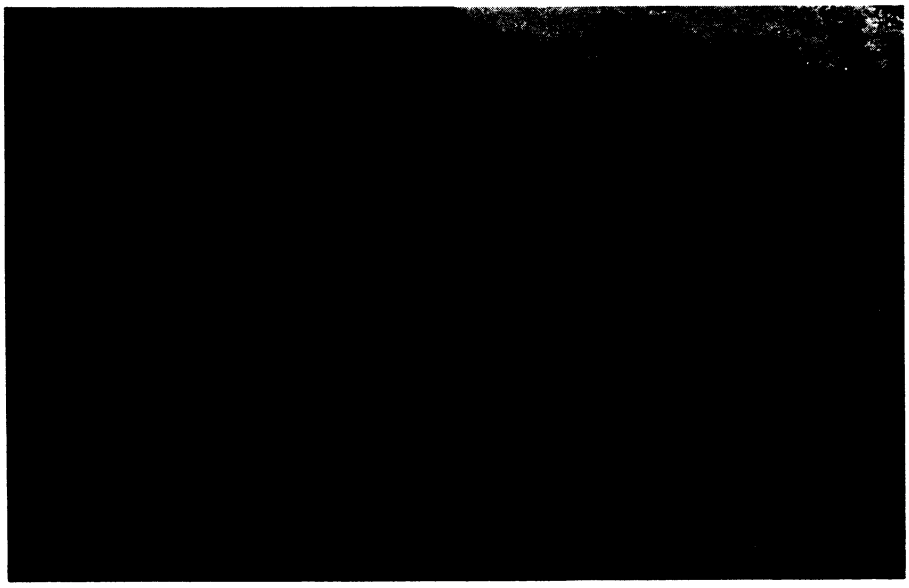
Element 96, curium, created by bombardment of uranium 238 and plutonium 239 in a cyclotron. Patent 3,161,462.

Bowl-shaped landing pads designed to support a vehicle landing two U.S. astronauts on the moon regardless of the type of surface. Patent 3,175,789.

A Pyrotron reactor aimed at controlling thermonuclear reactions using magnetic mirrors and an external magnetic field to contain the hot plasma in a cylindrical tube long enough to allow fusion. Patent 3,170,841.

An ion-exchange process by which radioactive strontium and cesium can be removed from milk if fallout produces a health hazard. Patent 3,207,607.

Another process to remove radioactive elements from milk using a continuous ion exchanger to remove the radioactive ions and replace them with non-radioactive ions. Patent 3,194,663.



NASA

HADRAMAUT PLATEAU—Among the photographs of the earth taken by the National Aeronautics and Space Administration's Gemini 4 spacecraft during its orbital mission was this view of the Hadramut Plateau, the southern part of the Arabian Peninsula. The Gulf of Aden is in the background.

A dome design utilizing the principle of "truncability" that permits building domes of different sizes and heights without changing the material. Patent 3,203,144.

A rocket that can return to earth under its own flying power, thus saving 80% of the rocket's cost. Patent 3,202,381.

A helium-filled inflatable suit that can lift a survivor away from the danger of a ship or aircraft disaster. Patent 3,176,935.

An all-weather system of navigation-by-satellite that uses the Doppler effect. Patent 3,172,108.

A thermotunnel converter that changes heat energy into electric power, free from the inherent limitations of both thermionic and thermoelectric devices. Patent 3,169,200.

A coating for runways made of mesh plaster sand, asphalt emulsion, water, Portland cement and powdered wood rosin that slows jet planes three times faster than regular runways. Patent 3,168,019.

A method for making wood resistant to rotting and termites that leaves a solid crystalline preservative permanently in the wood. Patent 3,199,211 and 3,200,003.

Sheets made of pulverized egg shell membrane to which other substances may be added, which improve healing when applied to burns. Patent 3,196,075.

A circular airport runway system that would minimize the hazards of being unable to stop shortly before take-off and of overshooting a runway. Patent 3,173,634.

A method for marking fish in which scales are transplanted painlessly from one part of the body to another. Patent 3,174,458.

An electric eye device that can scan the road ahead and can keep a car in the same lane, along the straightaway or around curves without the help of the driver. Patent 3,172,496.

An alarm system that responds to a variety of conditions in a building on normal telephone circuits to relay coded emergency signals. Patent 3,206,551.

A giant disposal that destroys classified information once it has served its purpose. Patent 3,192,853.

A floating hydrofoil runway that the airplane would not overshoot because the runway would travel beneath the plane as long as needed for takeoff and landing. Patent 3,191,566.

A contact lens containing a special dye that lights up when subjected to ultraviolet rays but will not interfere with vision. Patent 3,189,914.

A battery-powered "cigarette" that would allow inhalation of medication. Patent 3,200,819.

A contraceptive intrauterine plastic coil, flexible enough to be straightened but strong enough to spring into place upon insertion. Patent 3,200,815.

A lock that "recognizes" the voice pattern of a particular person and responds by unlocking itself. Patent 3,184,937.

A colorless spray to protect plants from being smothered by oxidizing substances in the air. Patent 3,178,855.

A microphone that "listens" to the activity of the joint, enabling early diagnosis of joint disorders not detectable by X-rays. Patent 3,181,528.

A computer that answers inquiries verbally using bits of sounds stored in the form of coded signals. Patent 3,183,303.

A burglar alarm that telephones the police when someone is breaking in and automatically takes pictures of the intruder. Patent 3,188,392.

A concrete made of a special alumina cement and an aggregate of volcanic rock that can withstand the heat of a rocket at blastoff. Patent 3,188,368.

A miniature air raid alert that could be installed in individual buildings and is activated by general power reduction. Patent 3,187,139.

Clinistix, a test for sugar in the urine using a chemical indicator strip. Patent 3,164,534.

A method of building an automobile so that the force of a crash is absorbed by the movement of the passenger compartment. Patent 3,162,479.

A prefabricated platform for drilling oil from the ocean's bottom, usable at a depth of 400 feet. Patent 3,209,544.

The distillation process used to make 14,400 gallons of pure water a day from salty water in Puerto Rico. Patents 3,214,348 through 3,214,351.

An aircraft that will either loiter in the air like a family two-seater or streak across the sky at supersonic speeds. Patent 3,215,369.

A process for making stretchable metal fabric from aluminum. Patent 3,213,168.

A system that will allow transmission of pictures over ordinary telephone lines instead of coaxial cable. Patent 3,204,026.

1965 is the 175th anniversary of the U.S. patent system.

SPACE

Mariner 4 passed within 6,118 miles of Mars and transmitted 21 pictures of the surprisingly moon-like planetary surface back to earth in July.

On March 18, Soviet cosmonaut Alexei Leonov spent 10 minutes outside his Voskhod 2 spacecraft, the first time any man had ever actually stepped into space.

While pilot James McDivitt flew the Gemini 4 spacecraft, co-pilot Edward White took the first U.S. "space walk," maneuvering himself around in space for 20 minutes with a compressed air gun.

France joined Russia and the United States as a participant in the space age when she launched her first satellite into orbit, a three-stage 18-ton rocket, on Nov. 26.

Astronauts Gordon Cooper and his co-pilot Charles Conrad set many records with Gemini 5, not the least of which was their eight days in orbit, proving that man can survive the lunar flight.

The first U.S. manned spaceflight in almost two years took place when Astronauts Virgil Grissom and John Young flew Gemini 3, the "Molly Brown," up, down and sideways, landing in the Atlantic after three orbits.

Ranger 9 in the 18 minutes prior to its impact on the moon transmitted some 5,814 pictures of the lunar surface of a quality exceeding the excellent records of Rangers 7 and 8 and bringing the total from the three Rangers to more than 17,700 photographs.

The search for extraterrestrial life, beginning with the unmanned investigation of Mars during the decade ahead, deserves the highest priority among all objectives in space science and the space program as a whole, a study group organized by the National Academy of Sciences concluded.

For the first time a man-made satellite, the Communications Satellite Corporation's Early Bird, was put into commercial service as a means of communication between continents, touching off a revolution that threatens the traditional communications methods of big countries and big companies.

Repeating the 1959 feat of Lunik 3, Zond 3 photographed some of the lunar surface

never seen from earth, revealing that there are fewer seas and more mountainous areas in those parts than on the visible side.

Luna 5, 6 and 7, the Soviet Union's three attempts at the world's first unmanned lunar "soft landing," all failed and crashed, although the last was reported to have its speed considerably reduced before impact.

Atlas-Centaur, the booster assigned to carry a succession of Surveyor unmanned spacecraft to the moon, scored a success with AC-6, delivering a dummy craft to an imaginary moon 240,000 miles out in space.

The Titan III-C, the Air Force's superworkhorse, carried a 21,000-pound dummy payload through a virtually flawless first flight, giving hope to scientists working on the Manned Orbiting Laboratory (MOL), which will probably be the III-C's first important passenger.

The IQSY Solar Explorer satellite was launched in November to measure and monitor solar X-ray emissions during the final portion of the International Years of the Quiet Sun; the international scientific community acquired data directly from the satellite.

The second Orbiting Solar Observatory (OSO 2), part of the U.S. contribution to IQSY, was placed in orbit with six of its eight experiments working, including solar X-rays, gamma ray and ultraviolet radiation monitors.

TIROS 9 (Television Infra-Red Observation Satellite), the first "cartwheel" satellite of the series, "rolls" in an elliptical orbit rather than circular as intended, taking pictures with its one operational camera.

TIROS 10, with both cameras working, brought the total number of working TIROS stations to four, since numbers 7, 8 and 9 are still operating.

The United States launched the first nuclear space reactor, SNAP 10A, into orbit aboard an Atlas-Agena booster, where it proved the possibilities of atomic power as an energy source in space.

The National Aeronautics and Space Administration correlated data from Pegasus satellites 1 and 2, each with huge 96-foot "wings," and concluded that meteoroids "probably will not be unduly hazardous" to spacemen.

Lawyers from countries around the world emphasized the need for an international code of space laws at a conference on World Peace Through Law.

The 160-million-horsepower Saturn S-IC, biggest booster the United States has yet produced, and first-stage-to-be for the Apollo lunar flight, was successfully test fired several times.

The Manned Orbiting Laboratory, which will keep two men in orbit for a month, was authorized and the contract for building it awarded.

Several kinds of plants were raised under a simulated Martian environment and shown to be able to survive with no oxygen and almost no water at all.

A recovery system utilizing parachutes that brings expensive research balloons back to earth for further use was developed.

• Science News Letter, 88:389 December 18, 1965

MEDICINE

Approve Treating Cancer in Pregnancy

➤ IT IS NOT A SIN in the Catholic Church to treat cervical cancer in a pregnant woman even though it may result in the death of the baby. This is because the primary purpose of treatment is to cure the cancer and not to kill the unborn child, a symposium in Philadelphia was told.

The desire for a child on the part of the parents, however, may cause them to delay treatment of cervical cancer until the baby can be born by caesarean operation.

In any case, said Dr. Richard E. Symmonds, Mayo Clinic and Mayo Foundation surgeon, Rochester, Minn., if such a cancer is discovered late in pregnancy or in the immediate period following birth, the outlook for the mother's recovery is poor.

Some physicians are neglecting the opportunity to make early diagnoses of malignancy in the neck of the womb. Although taking cell smears at the time a woman is examined for the existence of pregnancy in no way endangers the pregnancy, such doctors do not make this easy test.

Pregnancy itself does not appear to affect malignancy, but as in the case of nonpregnant women, early treatment is advisable. Approximately one percent of cervical cancers occur in pregnant women, complicating about one in each 2,000 to 3,000 pregnancies.

Unfortunately, no one doctor has had sufficient personal experience with the management of cervical cancer in the pregnant woman to allow a valid opinion on how best to proceed, Dr. Symmonds told the Hahnemann Medical College symposium on new concepts in gynecological oncology, or science of tumors.

Treatment of some type should be started immediately when cervical cancer is discovered, Dr. Symmonds recommended. If parents prefer to wait a few weeks however, he said it would be advisable to delay radiation treatment for fear of harming the fetus.

If the baby is born by caesarean section, a radical hysterectomy should be performed afterward, with pelvic node dissection. This procedure has been criticized in the past by other gynecologists, Dr. Symmonds said, but it now has a number of strong supporters.

• Science News Letter, 88:398 December 18, 1965