GENERAL SCIENCE

1963 Science Review

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

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, 1719 N St., N.W., Washington, D. C. 20036.

ARCHAEOLOGY

Potassium-argon dating established that the ancestors of modern man existed about two million years ago.

Searching for the ancient Greek city of Sybaris, archaeologists found two cities and did not accumulate enough evidence to tell which, if either, was Sybaris.

Analysis of charcoal remains indicated that man has lived in the Western Hemisphere for 32,000 years, twice as long as previously believed.

The remains of organic compounds made by living creatures are being studied in rocks up to three billion years old to learn how life may have started.

An ancient water system, indicating an important dwelling site of an ancient Indian population, was found on San Nicholas Island off the southern California coast.

Discovery of an enormous bed of animal bones of extinct and modern species indicated that African wildlife evolved in Africa, not in Europe or Asia.

A new class of Echinoderms was created for the 600-million-year-old spiral-shaped creatures found in a California fossil bed.

A "green peril" of microscopic algae, creeping across the walls of the Lascaux Cave in south central France, threatened and continues to endanger the Stone Age paintings.

From a clear Florida stream came underwater fossil finds, including a small antelope never before found east of the Mississippi, a large flightless bird and a giant land tortoise.

A trackway of dinosaur footprints, made some 140 million years ago, was found in a quarry in Dorset, England, and is being installed on the lawn of London's South Kensington Natural History Museum.

A 4,000 year-old house, in an excellent state of preservation, was excavated at the Chilca site on the Peruvian coast.

The remains of horses, wild oxen, a very rare rhinoceros, dozens of headless elephants, and stone and wooden tools were found at Torralba and Ambrona, Spain, hunting grounds of Stone Age man.

Plans to save the Abu Simel temples from the flood waters of the Nile that will be created by the new Aswan Dam were approved by the United Arab Republic and UNESCO and work was scheduled to begin.

ASTRONOMY

The most gigantic explosion ever known in the universe, the tremendous detonation of the heart of a distant galaxy of millions of stars called M-82, was hypothesized, and suggested as a prime source of cosmic rays.

A planet outside the solar system, named Barnard's Star B—a dark, lifeless giant half again as heavy as Jupiter—was reported to have been discovered.

The hydroxyl radical was discovered and measured in interstellar space for the first time, using a combination of radio astronomy and electronic computer techniques.

The moon was once a planet of the sun, but was captured by the earth; then it broke up and dumped about half of its matter on the earth to form the continents, a new theory proposed.

Radar mapping of Mars indicated the planet's surface is flatter than many scientists had thought.

Three colored areas in the Aristarchus region were observed by lunar mappers on Oct. 29; coloration in each case lasted about 20 minutes and may have been due to some sort of volcanic activity near the lunar surface.

An image-intensifying device that amplifies starlight up to 100,000 times was put in service at Kitt Peak National Observatory.

A total eclipse of the sun on July 20 was visible to a lucky few in a narrow belt crossing Alaska, Canada and New England, and as a partial eclipse to millions of others as far south as Latin America.

Radio sources 3C-273 and 3C-48, two billion and four billion light years away, were found to be exploding gas clouds in distant galaxies.

The first effective technique for measuring the ages of large number of stars like the sun, using lithium, was reported.

Studies of dwarf stars near the Milky Way's center showed our galaxy was born out of the gas and dust of the universe ten billion years ago.

The most accurate measurement so far obtained for the distance to the Andromeda galaxy showed it is 2.2 million light years away.

See Front Cover

The world's largest and most powerful radio-radar telescope, with a non-steerable reflecting dish in the shape of partial sphere that covers 18.5 acres, was completed on a mountain top near Arecibo, Puerto Rico.

A strange red star, one of the few red dwarfs known to be surrounded by and connected with a nebulosity, was discovered in the Hyades.

Gigantic cosmic accelerators are the source of radio waves broadcast in space by some galaxies, a Russian astronomer proposed.

The first spot of the new solar cycle was observed at high solar latitude; this family of sunspots will produce the solar storms of the next maximum in the 11-year sunspot cycle, about 1967 to 1969.

The surface of Mercury is more rugged than that of Mars and twice as rough as that of Venus, analysis of radar experiments indicated.

A belt of yet-to-be-seen comets lies near the pathway of Pluto, it was predicted.

A new method of radioactive dating using rhenium-187 gave the age of the Milky Way as 10 to 15 billion years.

Identification of the infrared absorption bands in the spectrum of Mars with organic substances is doubtful, it was reported.

BEHAVIORAL SCIENCES

Outstanding events in the Negro struggle for civil rights, such as the martyrdom of Medgar Evers and the Aug. 28 March on Washington for Jobs and Freedom, were predicted to have far-reaching psychological impact on many groups both here and abroad.

The hallucinogenic drug cult blossomed as thrill-seekers obtained mescaline, psilocybin, LSD and even morning glory seeds, as the Government placed restrictions on the use of these drugs, as scientists kept up their studies of how the drugs work and how they may help the mentally ill, and as new warnings were sounded of danger from use of these drugs.

A chemical compound resembling the hallucinogenic drug mescaline was identified in the urine of a high percentage of schizophrenics by an American and also by a Japanese team.

The Negro children who spearheaded desegregation in public public schools in the South were not seriously mentally damaged by their trials, but may have gained a sense of dignity and purpose, a study showed.

Monkeys in an experiment learned to control the behavior of colony mates by electrical stimulation of the brain.

Terror by paralysis was tested as a way to cure alcoholism, and many patients who had been paralyzed by drug injection and then given a sip of their favorite liquor did stop drinking.

A nationwide program was launched to help the mentally retarded, who are twice as numerous as persons afflicted with blindness, polio, cerebral palsy and rheumatic heart disease combined; Congress approved a four-year, $329 million program for construction of new community mental health centers.

Tests on newborn babies indicated they have the ability to see patterns.

Some psychologists charged that the U.S. fallout shelter program damages children's mental health.

Children born and raised in homes without books, good music and other cultural and educational advantages can become mentally retarded even though they had no physical damage before birth, it was reported.

The incidence of color blindness was found to increase as societies progressed from primitive hunting to settled agricultural ways of life.

Psychologists "taught" a computer to score a widely used personality test, the Minnesota Multiphasic Personality Inventory.

Adults have stereotyped and erroneous ideas about the abilities of normal children, an Italian professor found.

A downturn in the average size of the completed family began in the U.S.

One kind of optical illusion fools European man while another fools non-European man, a cross-cultural study showed.

A student voluntarily underwent five months of isolation to help in study of the stresses and strains of spaceship living.

A London doctor's report that reformed alcoholics might be able to return to social drinking was challenged by other specialists.

A study of sleepwalkers showed that a third of the somnambulists were definite schizophrenics, another third had marked schizoid tendencies and the others had neurotic disorders.

BIOLOGICAL SCIENCES

RNA, or ribonucleic acid, is now considered to be a partner instead of messenger of DNA, or deoxyribonucleic acid, in the complex system of heredity in living forms.

A large unexplored region of genetics was opened with the discovery of a mechanism for a second system of inheritance involving the

genes, but not the chromosomes, following an entirely different set of rules from chromosomal inheritance.

For the first time, the enzyme ribonuclease was partially synthesized in the laboratory; ribonuclease breaks down ribonucleic acid, or RNA, the genetic partner within each cell that tells the cell how to reproduce itself.

Life's basic genetic material, DNA, has been discovered to be in the shape of a ring in a small simple virus; other DNA molecules occur in long, usually double, intertwined strands of genes.

Another green pigment besides chlorophyll is believed necessary in the plant process of converting sunlight, water and carbon dioxide into food for the plant; the newly discovered pigment is called P-700, the P standing for pigment, and 700 for the absorbing wavelength.

The duplication of part of a gene was discovered in an analysis of three common types of a protein called haptoglobin; this duplication may be an important factor in the evolution of new forms of life.

Large molecules of DNA, deoxyribonucleic acid, the keys to heredity, reproduce themselves by unraveling in an orderly fashion from one end to the other, a discovery that may lead to control over normal and abnormal cell growth.

The newly identified iron-rich protein chemical called ferredoxin was found to be a key agent in transforming sunshine into food in plants.

A live duck growing a useless chicken leg was reported a rare example of a successful transplantation of different tissues.

Chemical compounds called "pacifarins" were reported to help animals adjust to disease-causing bacteria, rather than fighting to overcome them, opening the way to a new strategy of disease control.

New drugs can now be first tested on one-cell protozoa instead of on higher animals or man.

Round smooth unspecialized cells changed their shapes, became sticky and attached themselves to each other or the test tube just before they became specialized, it was observed.

Rats were reported to be hardy offshoots of a common ancestor of the primates from which man developed.

Methods devised to control air pollution included using depleted uranium in car muffler units and treating heavy residual oils for vehicles with industrial hydrogen.

Latest methods for cleaning up America's polluted waters were reported to include exposing soiled water to harmless ionizing radiation; fighting detergents with other detergents so that they neutralize each other; using radiation to produce new detergents that can be acted upon by bacteria when released to the environment; and removing wastes by forcing activated sludge and air foam through the water.

Eighteen species of terrestrial bacteria were found able to live in a simulated Martian environment; one moss, one lichen and three species of fungi also were able to survive.

More than 250 organic pesticides on the market were given close inspection by Federal, state and private organizations this year in an effort to guarantee their safe use.

Insecticides can now be detected in foods in a two-hour test that used to take two days.

An increasing number of mountains, forests, parks, dunes and seashores were classified as primitive wilderness, parks, historic sites or recreation areas.

Healthy flocks of the giant Canada goose, until recently considered extinct, were found in Minnesota.

New Chinese varieties of blight-resistant chestnut trees may take the place of America's native chestnut trees, destroyed by a blight in the early 1900's.

The dread cereal leaf beetle was found to be spreading through grain belt areas in Michigan, Ohio and Indiana, and farther into the north.

U.S. chemists produced more ammonia for fertilizer than ever before.

International plans for helping the world's 300 to 500 million hungry people were undertaken by the World Food Congress, first of its kind.

Liquid or gaseous ammonia treatment soon after fish are caught was tested as a solution to the problem of keeping fish from spoiling in the tropics.

Animals with a large portion of their brain removed soon after birth develop into adults not significantly different in intelligence and performance capability from their normal, unoperated litter mates, it was reported.

A cherry tree that flowers in the winter and orchids hardy enough to bloom through several light frosts were among ornamentals brought back by America's first plant exploration in the high Himalayas of Nepal.

Cut roses treated with ethylene oxide gas remained fresh looking and did not completely open their buds for as long as 70 hours after treatment; untreated rose buds were completely open within 40 hours.

A species of fungus, *Acaulopage pectospora,* that captures and kills soil-inhabiting nematodes was found and identified.

Equine piroplasmosis, a horse disease new in the United States, can be spread by the tropical horse tick, *Dermacentor nitens,* it was found.

Three substances that may someday be used against boll weevils were reported extracted from cotton plants: one repels the weevils, the second attracts them and the third makes the plants appetizing to the weevils.

A machine that uncaps honeycombs twice as fast and at less cost than uncapping by hand was developed.

A tough plastic made of pine gum rosin was reported to show promise for use in glass fiber-reinforced plastic boats, automobile and truck bodies, construction panels, furniture and home appliances.

A short-time process for artificially aging rice that gives rice cooking and eating qualities equal to those of naturally aged rice was developed.

A minute amount of concentrated material, ten drops extracted from five tons of celery, yielded most of the secrets of celery flavor.

Electric light traps, emitting near-ultraviolet light, reduced tobacco hornworm populations about 50% in a test area near Oxford, N. C.

Discovery that female flies produce a chemical substance that attracts male flies moved scientists a step nearer biological control of houseflies.

Full-fat soybean flour containing 40% protein and 20% fat that can be produced in simple, mobile equipment was evaluated as food for children in developing countries.

Accurate predictions of crop growth, a long-sought goal, was found possible using a new formula for measuring plant response to specific environmental influence.

Success in crossing two blueberry species opened the way to development of improved cultivated blueberry hybrids.

Stocks of seed for use in the development of hybrid wheat having the quality characteristics of leading commercial varieties were made available to recognized breeders throughout the world.

Potted azaleas can be made to bloom any time of the year by special treatments that combine chemical growth regulators and reduced light periods, it was found.

The oriental fruit fly was eradicated from the Pacific island of Rota by using an attractant to lure the male flies to an insecticide that killed them, thus preventing reproduction of this species.

Cotton fabrics were developed that can be chemically treated to make them moldable into three-dimensional shapes for use in manufacturing furniture upholstery, hats, shoes and many other consumer items.

CHEMISTRY AND PHYSICS

Experimental evidence pointing to a new kind of particle, called a "W" particle because it is involved in weak interactions, one of the four basic forces of nature, was discovered through statistical analysis of the fragmented matter resulting from neutrino bombardment.

When the particle-antiparticle relationship is incorporated in Heisenberg's original principle, the idea of momentum can be developed into a theory, the scattering matrix theory, explaining what particles really are, it was reported.

A new particle of antimatter, called the anti-Xi-zero, the last predicted member of the known family of stable and quasi-stable particles, has been discovered by two teams of physicists.

Another nuclear particle, named the "phi meson," was discovered.

The chemical molecule, adenine, essential to all life processes, was synthesized under simulated primeval conditions in the laboratory, reinforcing the view that life could have evolved through chemical evolution.

President Lyndon B. Johnson, on behalf of the Atomic Energy Commission, presented the Enrico Fermi Award to Dr. J. Robert Oppenheimer, director of the Institute for Advanced Study, in a White House ceremony planned by the late John F. Kennedy and attended by a host of top Government officials.

In order to understand the fundamentals of matter and solve the mystery of nuclear particles, a Presidential panel recommended construction expenditures of $12 billion during the next 20 years for exploring the nucleus; included was construction of a super atom smasher that would fling protons with energies up to 1,000 billion-electron volts at targets.

Two new major accelerators, one for protons at three Bev in New Jersey and one for protons at 12.7 Bev in Illinois, went into full operation; major modifications on the bevatron in California were completed.

Harnessing light for communications has been brought much closer to reality with discovery of a method of making the extremely intense beam of laser light have any desired color by passing it through a crystal, and a method of amplifying this single-colored light beam by passing it through a liquid to achieve parametric amplification.

Practical use of light for communications was given another boost to reality by sending audible information on a laser light beam.

The random pulses of a laser were converted into uniform, repetitive pulses of up to 500,000 a second with power in the light beam equivalent to about 20,000 hundred-watt bulbs.

Discovery was reported of a loophole in what was previously believed to be a barrier to the use of "magnetic mirrors" in controlling thermonuclear reactions, thus allowing scientists to conduct future research at a new level of understanding.

Digging earth by atomic explosions proved successful but use awaits development of a "clean" process.

A sensitive technique for measuring such light elements as carbon, oxygen and nitrogen in trace quantities previously undetectable was developed, using helium-3 nuclei from an atom smasher to make the atoms radioactive.

High-temperature-resistant diphenyl oxide polymers were reported on their way to wide use in industry.

Metals were found alternately to shrink and to stretch at very low temperatures when a nearby magnetic field is smoothly varied.

Pea-sized structures locked inside stony meteorites, or chondrules, were reported to contain the oldest solid material in the solar system.

A new testing method taking only four to six hours was developed to measure water pollution.

A magnetic memory device that looks somewhat like a miniature waffle iron was reported to be promising for large capacity computers and switching systems now using ferrite cores and thin films as memory devices.

Optical maser oscillation was observed in four more gas systems—nitrogen, bromine, carbon monoxide and sulfur hexafluoride; and the number of different frequencies emitted by noble gas lasers was increased to more than 150.

A new laser material, magnesium fluoride doped with nickel ions, which in addition to emitting coherent infrared light, also generates vibrations, called phonons, in the crystal lattice was developed.

A method for obtaining a stable magnetic field that can also be readily changed, using a thin-walled superconducting tube to shield and stabilize the field, was devised.

A new theory about what makes materials stick together holds that theoretically any two materials can be made to adhere strongly; secret lies in knowing which of the two materials must be fluid when brought into contact with the other.

The Nobel Prize in Physics was awarded to Dr. Eugene P. Wigner, Princeton University physicist who won half the $51,000 prize, sharing it with Drs. Maria Goeppert Mayer of the University of California and Dr. J. Hans D. Jensen of Heidelberg University.

The Nobel Prize in Chemistry was awarded to Dr. Karl Ziegler, director of the Max Planck Institute for Coal Research at Mulheim-Ruhr, West Germany, and Dr. Giulio Natta of the Polytechnic Institute of Milan.

Highly valuable man-made elements—berkelium, californium, einsteinum, and fermium—were separated after they had been produced in a tiny aluminum capsule that had been in the high neutron flux of a reactor for four years.

ENGINEERING AND TECHNOLOGY

A rat's natural electricity was used to generate radio signals by a transmitter attached to its body.

Experiments with SECO (SEquential deCOding) were begun in which computers accurately and quickly exchanged information in a binary digit code.

A dual-chambered syringe that permits separate vaccinations for different diseases to be made at the same time was developed.

Oil, as a source of carbon, can be used to provide proteins for the future, it was reported.

A world "common knowledge market" received a significant start at Geneva, when industrial nations such as the United States and the Soviet Union shared knowledge with less developed countries.

A fire-retardant paint that protects, looks and lasts like wood, and can be applied with brush or roller was reported ready for general distribution within a year.

Sending radio waves through the granite rock mass of the earth's crust was investigated as a means of protecting messages from man-made or atmospheric interference.

Formation of the National Academy of Engineering was approved by the National Academy of Sciences.

A phosphor of zinc cadmium sulfide was stimulated with a direct electrical current and a radiation source, producing a luminescent image for half an hour.

A desk-size "conditioned reflex" machine was built for the Air Force to recognize photographs of aircraft and people.

Painless sampling of human skin was done with an electric core drill touched momentarily to the skin.

The Chesapeake Bay Bridge-Tunnel, one of the world's future engineering wonders, neared completion; the engineering feat is composed of spans of trestles, four man-made islands, two bridges and two tunnels.

Computer data were flashed 40 miles over a television channel at a rate of 33 million words per minute and back, in the fastest transmission of data over telephone lines and television channels.

The area being most actively searched for deposits of natural gas is in the sands of an underground rock formation extending under the North Sea near Holland.

A computer was used to analyze the chemical constituents of human blood.

Infrared cameras were put to increased use as detectors aboard planetary probes, and weather and military satellites.

Wurlanizing, a method of producing shrink-proof, machine-washable woolens, was developed.

A porous synthetic material that "breathes" may some day replace leather in shoe manufacturing.

A machine to suck up boll weevil larvae feeding in cotton flower buds, mash them up and blow them harmlessly back to the ground was developed.

A new method of producing the plastic, melamine, from natural gas was reported.

An electric device to "milk" the venom of bees and other insects for use in vaccinating allergic persons was developed.

A return to rails, above and under the ground, was foreseen as the answer to the problems of mass transit and traffic congestion.

A cereal product was added to wood pulp to produce insulation boards stronger and lighter than commercial boards now available.

A switch flipped on and off by liquids or gases instead of electricity was under study.

Solar energy was used on the Pacific Coast to desalt ocean water on a scale adequate to furnish drinking water.

A new prime number, 2,917 digits long and the biggest ever proved, was calculated by a computer.

Color film for Polaroid cameras opened a new era of instant color photography.

High-speed jets of water were used to cut lumber more effectively than saws.

Helicopters were used to transport valuable timber logs from inaccessible spots in the forest.

An electronic telephone switching system that operates in millionths of a second, provides new kinds of telephone service, and is compatible with existing electromechanical switching systems was announced and field trials were begun.

A new 3,500-mile transatlantic telephone cable was laid between New Jersey and England.

Large zinc oxide crystals were grown from seeds by an easily controlled hydrothermal process.

Temperature changes as small as a hundred-thousandth of a degree centigrade were measured by a new quartz thermometer capable of making the most sensitive measurements of any to date.

Perspective movies, computed and drawn by an electronic data processing system, were used to help scientists visualize the motions of an orbiting communications satellite.

GENERAL SCIENCE

A partial nuclear test ban treaty was successfully negotiated by the U.S., Great Britain and Russia, was signed by more than 100 nations, and for the U.S. was notably supported by 35 U.S. Nobel Prize winners.

The violence-spiked atmosphere prevailing in the United States helped to spur President John F. Kennedy's assassin to his crime, psychiatrists said.

President Lyndon B. Johnson changed the name of Cape Canaveral to Cape Kennedy, and Station No. 1 of the Missile Range and Launch Facility was renamed the John F. Kennedy Space Center.

In a speech to the United Nations General Assembly, President Kennedy advocated cooperation with the Soviets on lunar exploration and in the effort to land men on the moon.

Formation of a special Congressional committee to investigate overlapping and priorities in Government-sponsored scientific research was approved.

The National Academy of Sciences, advocating the development and use of birth control techniques to check excessive population growth, joined the growing ranks of those concerned with population problems and helped spur research efforts in this field.

Putting scientific knowledge at the disposal of developing nations was explored by bringing together representatives of the nations of the world at Geneva in a conference dubbed a "common knowledge market."

Dr. Leland J. Haworth, Atomic Energy Commissioner, was named director of the National Science Foundation, succeeding Dr. Alan T. Waterman.

The National Science Fair-International was held in Albuquerque, N. Mex., in May and had 219 affiliated fairs participating from 46 states, the District of Columbia, Puerto Rico, Canada, Germany-France-Italy, Japan and Sweden.

The National Academy of Sciences celebrated its hundredth anniversary.

Nobelist Linus Pauling was awarded the 1962 Nobel Peace Prize (not awarded in 1962), making him the second person ever to win two Nobel Prizes; Mme. Curie was the other.

The U.S. and the USSR reached an agreement for cooperation in the field of nuclear energy, result of a trip to Russian facilities by a ten-man team whose jet flight to Russia set a nonstop speed record between Washington, D.C., and Moscow and shattered 14 other air records.

A phenomenon, called EMP for electromagnetic pulse, received wide attention as a method of disabling radar, electronic control and communication equipment when a nuclear blast is detonated at a low level.

GEOPHYSICS

Electronic computers, already in routine use for daily, five-day and 30-day forecasts, were used to help the U.S. Weather Bureau forecast weather trends for an entire season experimentally.

The nuclear-powered submarine Thresher was crushed beneath the pressure of the ocean.

Scientists completed final plans for the International Years of the Quiet Sun (IQSY), starting Jan. 1, 1964, during which sun-earth relationships will be studied at a time of minimum solar activity.

As part of the continuing International Indian Ocean Expedition, a new geologic map of the Indian Ocean reveals that sea floor rocks are diverse in composition and could contain petroleum and other valuable mineral resources.

Plans were made for the International Upper

Mantle Project, a study of the earth's interior extending roughly from 20 to 450 miles below the crust.

A World Magnetic Survey, in which a string of worldwide observation stations, together with ships, planes and satellites, will help map the earth's magnetic field, was announced.

Plans were reported for an International Hydrological Decade, an intensive scientific investigation of the world's water resource problems.

A 1,000-foot core of serpentine rock brought up from the earth's crust near Puerto Rico as part of Project Mohole was studied to learn the earth's composition beneath the ocean.

New evidence based on magnetism in rocks, cleavages in the ocean's crust and mid-ocean ridges, supporting the theory of continental drift, was reported.

An ocean depth of 4,000 feet was reported to be the best underwater layer for trapping sound waves for long-distance transmission across the ocean.

Debris from beneath the ocean floor showed a colder climatic change 800,000 years ago started the evolution that ended in man.

Volcanic-like water, rich in gold, silver and rare metals and key to some of earth's inner secrets, was tapped for the first time in a mile-deep well.

The Skoplje earthquake killed more than 1,000 persons, injured many more and almost completely destroyed the Yugoslavian city in July.

A landslide fell into a reservoir behind a thin arch dam in Italy and spilled millions of tons of water, drowning an estimated 2,200 persons.

The deadliest Atlantic storm ever to hit the Western Hemisphere, hurricane Flora, killed more than 4,000 people in Cuba and other tropical islands.

More than 10,000 persons were killed by a storm that swept East Pakistan on May 29.

A bitter cold wave, late in January, set new below-zero records for most of the Midwest and southeast United States; the severest cold of the century was recorded in England.

In September and October, most of the U.S. east of the Rocky Mountains suffered a severe drought.

The rising of certain Melanesian islands during the past several million years was reported, supporting evidence that the earth's surface is elastic, resting upon a plastic layer.

The high-altitude nuclear explosion in July 1962 was found to have left energetic trapped electrons in the lower natural radiation belt that will persist for several years.

The satellite Explorer XVII carried out a series of measurements on the neutral constituents of the upper atmosphere, as well as the ionized one, whereas previous atmospheric measurements have made use of the naturally occurring ions; the first direct measurements of neutral molecular nitrogen, helium and atomic oxygen were made.

The measurements of cosmic dust particles made by Explorer XVI, when combined with measurements from other satellites and space probes, indicated that the dust particles are most numerous near the earth and that they do not constitute as great a danger to space travel as some scientists had feared.

Particles were reported to have been recovered from the high latitude noctilucent clouds that contain solid cores—possibly cosmic dust particles—covered by a shell of ice.

The document "U. S. Standard Atmospheres, 1962" made its general scientific impact in 1963; it is an effort to produce a standard atmosphere in accordance with the results of space research in the upper atmosphere.

Successful measurements of dayglow were obtained by using ultraviolet spectrometers carried on sounding rockets.

Data returned by Explorer XIV showed a region on the night side of the earth that is relatively devoid of energetic trapped electrons.

The earth's magnetic field was reported to be shaped like the front end of a somewhat blunt bullet, extending ten earth radii toward the sun and more than 16 earth radii away from the earth.

X-rays striking the earth's atmosphere from space and causing geophysical phenomena such as auroras were found to behave the same way in both hemispheres.

A new system for measuring rainfall as far as 100 miles away, called the radar precipitation integrator, was tested by the Weather Bureau for future use in forecasting river and flood conditions.

Dr. Francis W. Reichelderfer retired after 25 years as chief of the U.S. Weather Bureau; using orbiting weather satellites and electronic computers to help forecast the weather were two of his many achievements as head.

The 18,000-year-old riverbed of the Susquehanna River, long searched for by geologists, was discovered buried many feet below the present floor of the Chesapeake Bay where it runs into the ocean at Norfolk, Va.

A program to study the daily rise and fall and stretching of the earth's crust was announced.

An ultrasonic "thermometer," or transducer, was used to take the ocean's temperature by changing electrical pulses to mechanical vibrations that can be measured at the surface.

The earth's crust was reported to be 30 to 40 miles deep beneath the Colorado Rockies, only 10 miles deep in central California.

A new technique of producing man-induced rainfall, by using black asphalt patches as a giant radiator to heat moist sea air, was reported.

Project Skywatch was inaugurated for school children to record clouds, wind and temperature from the ground as the weather satellite Tiros VII passes overhead.

Two distinct belts in the atmosphere, one at about 73,000 feet and a fainter one at about 173,000 feet, resulting from the explosion of a volcano in Bali in March, were discovered to be the cause of uncommonly red sunsets; when the sky is clear, the first dust band can be seen about a half hour after sunset, the second another half hour after that.

Tiros VI, the U.S. weather satellite which was orbited Sept. 18, 1962, remained operational until Oct. 11, 1963, taking about 59,830 useful photographs during its record-breaking lifetime.

Evidence was discovered that the first Ice Age of the Pleistocene Epoch began abruptly more than 800,000 years ago.

A worldwide storm of feeble earth tremors, the first of such widespread proportions ever recorded, was reported to have been detected by long period seismographs throughout the world on June 6, 1961.

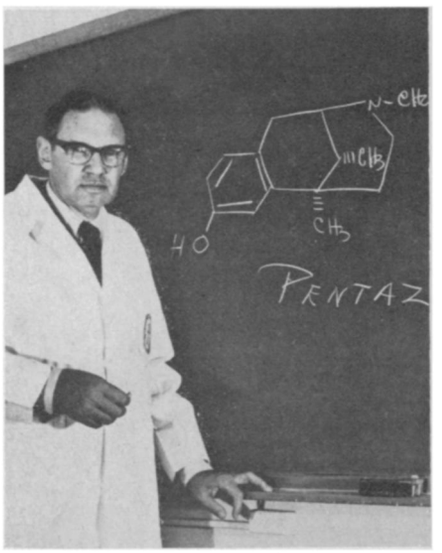
An ocean-bottom seismograph capable of accomplishing a major breakthrough in detection of underground nuclear weapons tests will be placed on the bottom of the Pacific off the California coast, it was reported.

MEDICAL SCIENCES

A nonaddicting substitute for morphine called Pentazocine was developed after more than a decade of research on a group of compounds called benzomorphans.

A key to finding the cause and treatment of cancer was reported in the balance between two newly-found substances called promine, which causes sudden cell growth, and retine, which holds back growth.

Synthesis of "an insulin" was achieved which, when perfected, could make it possible to do away with producing insulin from the pancreas glands of slaughtered animals and make simpler the widely used treatment of diabetes.



Sterling-Winthrop

MORPHINE SUBSTITUTE—Dr. Sydney Archer of Sterling-Winthrop Research Institute, Rensselaer, N. Y., has chalked up the formula of a non-addicting drug that substitutes successfully for morphine. Dr. Archer was one of those who worked on the drug, called Pentazocine, which was announced in August.

Total synthesis of ACTH, the important hormone used in the relief of rheumatoid arthritis and other serious illnesses, was accomplished, marking a step forward in basic biochemical research.

Ortho-Novum 2MG was reported the most promising birth control tablet, with fewer side effects, and the most efficient in preventing pregnancy in smaller dosages than previously used pills.

Organ transplants continued to be most successful between identical twins, but for the first time monkey kidneys were transplanted to a woman whose own diseased kidneys were not removed, although the transplants had to be removed after ten days; other transplants from unrelated cadaver kidneys showed promise in human living patients; and in animal research, frozen organs were stored for later thawing and transplanting.

Malaria, the chills and fever scourge that still takes an estimated million and a half lives each year throughout the world, was reported virtually driven out of Europe.

Krebiozen, the controversial anticancer compound produced from horse serum, was reported by the U.S. Food and Drug Administration to be creatine, normally found in the human body; it was declared scientifically worthless by the National Cancer Institute, after a committee of 24 scientists studied 504 cases referred to the Institute by proponents of the treatment.

The world's population passed 3,180,000,000 in mid-1963, showing a gain of 185 million in only three years, and causing the Population Reference Bureau to ask that "man-on-the-moon" priority be given to the population crisis.

Colombia passed a law requiring drug sales under scientific or medical names rather than the trade names that are more expensive; its passage caused a Senate subcommittee to hold closed-door meetings of U.S. pharmaceutical

manufacturers because of the law's broad implications for this country.

Advance was made in research on humans with multiple sclerosis, some of whose blood showed regeneration of myelin, the fatty sheath of nerve fiber, in test tube cultures; this experimental work was previously done on the blood of laboratory animals in which experimental "allergic" encephalomyelitis was produced.

The U.S. influenza epidemic of January-April took 55,000 lives, the Public Health Service announced.

An increase in emphysema deaths in this country led to a study of 50,000 immigrants and 20,000 American-born persons in the hope of finding geographical and other environmental causes; the research is continuing.

Basic research in botulism, the canned food poisoning that killed a number of persons in the United States in 1963, showed that the poison affects the nerves but is blocked by serotonin, a derivative of the amino acid tryptophan.

Isolated brains were kept alive for the first time outside the bodies of monkeys for as long as 180 minutes through surgical elimination of all active tissue surrounding the brains, plus connecting blood vessels to other animals.

Measles vaccines—both killed and live, weakened virus types—received U.S. Public Health Service stamp of approval for meeting required standards.

Committees of the American Medical Association and the National Academy of Sciences urged that medicine be the method of choice in treating drug addicts.

A chemical defect in the blood of leukemia patients could explain the mysterious overproduction of white blood cells that characterizes this form of cancer, it was reported.

A single dose of the drug Cytoxan, or cyclophosphamide, made experimental skin grafts last longer than when given frequently over a prolonged period.

The Fischer quintuplets born in Aberdeen, S. Dak., were only the fourth set to be recorded officially in the entire Western Hemisphere; the third set, the de Prieto quints, were born in Venezuela earlier in September.

The new drug IUDR, or 5-iododeoxyuridine, showed promise in treating human cancer when combined with the cell chemical thymidine, which protects bone marrow that otherwise is harmed by IUDR.

The new regulations of the U.S. Food and Drug Administration went into effect, with plans for a "Supreme Court" on drug safety under the sponsorship of the National Academy of Sciences, to which both Government and the drug industry could turn for help.

One of the most severe abnormalities with which a child can be born—exstrophy, or a turning inside out of the urinary bladder—was corrected by surgery.

Continued investigations of the Atomic Bomb Casualty Commission show a slight rise in the incidence of thyroid cancer among those who survived radiation exposure from the Hiroshima and Nagasaki bombings in 1945; eight cases of thyroid cancer were reported to have been diagnosed during the past three years among persons who were six to twenty years of age at the time of exposure.

Frequent pregnancy tests were advised to aid doctors in avoiding the prescription of drugs that could harm unborn babies as thalidomide did.

The anticancer drug methotrexate continued to chalk up successes, one of which was in treating a deadly skin growth that often develops into leukemia-like cancers of lymphatic tissue; another in aiding bone marrow transplantation through injection.

A new pregnancy test called Pregnosticon, which takes two hours in a test tube, was developed cooperatively by scientists in Sweden, the Netherlands and the United States.

Transfusions of large amounts of fresh blood platelets, substances that aid in blood clotting, were found to be an effective treatment for hemorrhage in patients with acute leukemia, spreading cancer and bone-marrow depression resulting from drug treatment.

Studies showed other drugs besides thalidomide caused gross malformations in the offspring of pregnant experimental animals; one of these drugs was Bonine, a popular nonprescription drug used by American women for dizziness and nausea, which might in the future have to carry a label "safe use in pregnancy not established" or require a physician's prescription.

Patients were still apparently free of thyroid cancer 13 years after surgery and treatment with radioactive iodine, follow-up examinations showed in the most encouraging report so far published.

Workers in metal mines were reported to have three times more lung cancer than others in surrounding communities, irrespective of their smoking habits, indicating that chemicals inhaled inside the mines were to blame.

Allergies to penicillin and other drugs, which can cause death, were reported determinable by a new test, safer than those previously used.

A tiny new balloon attachment at the tip of a long tube was inserted into dangerously clogged arteries to sweep away the blood clots.

Babies could be headed for high blood pressures as a result of getting too much salt in cow's milk and in commercial strained infant foods, tests showed.

With the U.S. Public Health Service report on smoking and its relation to health due at year's end, research showed that the lungs of cigarette smokers may "age" as much as 20 years more than normal and that smoking multiplies other risks of getting lung cancer.

Measles vaccine for children allergic to egg protein was reported safe in preliminary tests in which the children were also given modifying gamma globulin.

Vaccines for both serum hepatitis and infectious hepatitis were reported closer to reality as experiments continued in humans; a vaccine against infectious hepatitis in dogs was achieved, and it was found that non-human primates are a source of human hepatitis.

Premature babies, including the son of President John F. Kennedy, continued to die of hyaline membrane disease, which causes breathing difficulty.

The 1963 Nobel Prize in Medicine or Physiology was shared by an Australian, Sir John Carew Eccles, and two Cambridge University English scientists, Drs. Alan Lloyd Hodgkin and Andrew Fielding Huxley, for their studies on how nerve cells operate.

The National Institute of Child Health and Human Development was established at the National Institutes of Health by Act of Congress; the new Institute will focus on research into prenatal and childhood diseases, on the one hand, and the problems of aging, on the other.

The use of silicone was reported as one of the most promising treatments to prepare a deeply burned patient for early grafting to prevent infection.

Chilling the skin during radiation treatment of cancers of the neck and head was reported to improve the effectiveness of the therapy.

Successful treatment of Cushing's disease, characterized by moon-shaped face and a peculiar obesity, was accomplished using an atom smasher.

A tiny baby weighing only three pounds, two ounces, lived after an operation to correct an unusually large connection between two arteries near the heart; she is believed to be the smallest baby ever to survive such an operation.

In open-heart surgery, a five percent dextrose solution, instead of blood, was used to prime the heart-lung machine, thus alleviating blood-procurement problems.

Studies of protein synthesis in a mammalian cell system indicated that at least a part of the genetic code is universal.

Success was reported with permanent prostheses of Teflon in the tracheas of experimental animals, important clinically in surgery for lesions involving the trachea.

A new anabolic steroid compound combined with digitalis showed some beneficial effects in arresting muscle wasting in progressive muscular dystrophy.

A single, oblique chest lead electrocardiogram technique capable of screening 30 to 50 patients an hour was developed, a technique of value for annual or periodic industrial employee health check-ups, for screening school children and for obtaining EKG's during exercise.

A small, low-cost artificial kidney—easy to assemble and maintain—was developed that is apparently equal to any of the expensive, popular dialysers.

A new, experimental anti-malarial drug, CI-501, that gives ten times the protection of conventional drugs was discovered.

A method was developed for transplanting living, self-generating bone grafts—with their own blood supply—that heal like ordinary fractures within six weeks.

A simple and rapid diagnostic test for mitral stenosis was devised that uses a sonar device to chart heart pulsations.

An implantable, synchronous cardiac pacemaker was developed for the long-term correction of complete heart block.

The cause of infant colic may be a deficiency of the hormone, progesterone, which in infants serves as a muscle-relaxant, it was reported.

Brain research was aided by a new cooling instrument and technique capable of blocking nerve conduction in isolated brain areas in unanesthetized animals.

Home treatment can prevent hospitalization of 50% of mentally ill patients who appear to be hospital-bound, it was found.

Melatonin, possibly a new hormone, alters ovary weight and estrous cycle.

A serum test for newborn babies was reported to provide a useful method for detection of phenylketonuria in the third or fourth day of life.

PATENTS

Numbers following items are U.S. patent numbers. Printed copies of patents can be obtained from the U.S. Patent Office at 25¢ each. Order by number, do not send stamps, and address orders to the Commissioner of Patents, Washington, D. C. 20231.

Notable and interesting inventories patented during the past year include:

Patent 3,100,294, for a time-division multiplexer used in space data computers, was the first ever issued directly to the U.S. Government instead of to an inventor, a change of policy under the 1958 Space Act.

A method of electrostatic printing in which dry ink particles are attracted to fruit, bricks or any material by an electrically-charged backing plate. Patent 3,081,698.

A laser in use as a surgeon's scalpel to repair damaged eye retinas. Patent 3,096,767.

Tiny glass fibers, through which light travels, used as probes that permit doctors to "see" hidden parts of the body. Patents 3,068,739 and 3,068,742.

A belt that propels spacemen by tubes of compressed gas attached to the belt. Patent 3,066,887.

Jets of compressed gas that reduce and control the spinning rate of orbiting satellite solar

observatories. Patent 3,072,363.

A tourniquet system that automatically alternates pressure between the arms and legs for predetermined time periods. Patent 3,101,085.

A chemical pesticide for protecting the oyster population from marine predators. Patent 3,103,202.

A nuclear gyroscope that uses the principle of the spin of the atom to stabilize aircraft in space. Patents 3,103,620; 3,103,621; 3,103,623 and 3,103,624.

An underwater "island" formed by a submerged buoyant tank containing a derrick for oil-drilling operations offshore. Patent 3,080,583.

A method of reducing sound transmitted from a ship by surrounding the hull with an air-bubble shield. Patent 3,084,651.

The bell-shaped Mercury space capsule that protected six American astronauts in orbit. Patent 3,093,346.

A fish scaler and cleaner that trails in the water behind the boat cleaning and scaling automatically. Patent 3,095,601.

A device for freeze-drying blood, food and other materials at atmospheric pressure. Patent 3,096,163.

An internally worn artificial heart driven by a motor that circulates the blood. Patent 3,097,366.

A sun tracker guidance system by which a missile or satellite corrects its own course without any help from earth. Patent 3,098,934.

A device that traces the path of a net under water to give a fisherman a larger catch of fish. Patent 3,104,928.

A nuclear reactor that uses inexpensive pellets for fuel. Patent 3,058,897.

The method and equipment for making champagne from wine in a continuous process. Patent 3,062,656.

A method of raising sunken ships by injecting plastic foam into the ship, displacing water and restoring buoyancy. Patent 3,091,205.

A nuclear reactor whose inside ring rotates like a lazy Susan to produce needed short-lived isotopes for medicine, research and industry. Patent 3,094,470.

A method of extracting proteins from fish for use in baking as a substitute for egg white proteins. Patent 3,099,562.

A telephone switchboard for the blind consisting of a series of identification pins that can be felt by the operator. Patent 3,057,965.

A motorless wheel chair that can actually climb stairs. Patent 3,104,112.

A "flying automobile" that uses the same power plant for the propellers as the wheels. Patent 3,090,581.

A method for converting light energy to mechanical action for operating window shutters or blinds. Patent 3,067,572.

A cup and saucer designed not to slip, drip or tip. Patent 3,067,904.

A safe way to produce pure cultures to develop vaccines and toxins for bacteriological warfare and peaceful research. Patent 3,075,888.

A "sea sled" towed along the ocean bottom at an angle for marine photography. Patent 3,082,731.

A cheap way of transporting oil underwater, using a "submarine-tanker" towed by a smaller surface craft. Patent 3,085, 533.

Two methods for using nuclear fission chain reactions to produce power, held secret 15 years. Patents 3,070,529 and 3,102,851.

A cheat-proof teaching machine for students. Patent 3,056,215.

A space trainer that can completely duplicate a space flight from take-off to landing. Patent 3,083,473.

A flameproof, synthetic Christmas tree assembled without any fasteners. Patent 3,064,379.

An electronic reading machine that can read 10,000 characters a second from adding machine tapes with great accuracy. Patent 3,104,369.

SPACE

Soviet Lt. Col. Valery F. Bykovsky, 28, was launch in the Vostok V spacecraft on June 14 and orbited the earth 81 times, covering two million miles in 54 minutes less than five days, a new space endurance record.

In an apparently unsuccessful attempt to link up with Vostok V, Valentina V. Tereshkova, 26, the first woman in space, orbited the earth 48 times in 70 hours, 50 minutes aboard Vostok VI; she and Col. Bykovsky parachuted to earth the same day.

United States Astronaut L. Gordon Cooper, in the last of six Project Mercury space shots, orbited the earth 22 times in his capsule, Faith VII, May 15-16.

The United States successfully orbited Tiros VII, a weather satellite containing two wide-angle television cameras, infrared sensors and an electron temperature probe, that obtained vital data during storm seasons and measured the earth-sun heat balance.

The U.S. Navy launched the first satellite to be powered wholly by nuclear energy, a Transit satellite with a power plant called SNAP 9-A that weighs 27 pounds and is fueled by plutonium-238.

The data acquired from the Mariner II flight past Venus were interpreted as showing that the planet has no surrounding region of trapped energetic particles; has a mass equal to 0.81485 that of the earth; its surface temperature is 800 degrees Fahrenheit, and solar winds of plasma cross interplanetary space from time to time.

The X-15 rocket ship, with Joseph A. Walker of the National Aeronautics and Space Administration at the controls, set a record altitude of 354,200 feet, or 67 miles.

McGill University of Canada aimed a 16-inch U.S. cannon straight up and shot a 475-pound capsule of weather instruments 15 miles into the upper atmosphere in the first launching of a high-altitude probe by gun instead of rocket.

Telstar II, a communications satellite owned by the American Telephone and Telegraph Co. and launched by the National Aeronautics and Space Administration, successfully transmitted black-and-white and color television as well as voice messages between the United States, France and England.

Syncom II was the first satellite launched into a synchronous 24-hour orbit; it is being used for experiments in communications.

Relay I, which in December 1962 became the first launch with the revised Delta rocket, successfully transmitted telephone, television, teleprint and facsimile signals between the United States, England, Italy and Brazil.

In a communications experiment, the U.S. Air Force launched 400 million copper needles that spread out in a thin, narrow belt about 2,000 miles above the earth's surface, for bouncing radio signals back to earth; the needles are expected to drift harmlessly back to earth within the next five years.

The British and French Governments agreed to joint development of a 1,450 (Mach 2.2) supersonic airliner.

A new generation of air transport, passenger and freight planes that will travel at twice the speed of sound was assured.

The first earth-space radio license was granted by the Federal Communications Commission to a private concern, permitting experimental work in satellite and related space communications.

Space communications experiments between two transportable ground terminals were successfully conducted.

Scientists began measuring the number of charged particles in the ionosphere by tracking hissing and whistling sounds first detected in radio receivers on the Canadian-instrumented satellite Alouette, which provided the first means of studying the ionosphere with radio waves bounded onto it from above and within the charged air layer.

The U.S. scientific satellites Explorer XVI and XVII measured micrometeoroid impacts on satellite skin samples, compared the performances of protected and unprotected solar cells in space, and took readings of the earth's atmospheric conditions at a variety of altitudes.

Radio contact was lost with a Mars Soviet probe in March, three months before its scheduled rendezvous; it was to have sent back photographs of the planet.

In separate ballistic launchings, France fired two rats, fitted with a series of electrodes attached to the brain and muscle areas, one of which was recovered after a 70-mile flight.

A new heat-sensitive telescope at the U.S. Air Force's Cambridge, Mass., laboratories was turned skyward in an effort to detect silent satellites.

In a program called Vela Hotel, the United States orbited the first two of a complex system of 485-pound "watch-dog" satellites 60,000 miles up to conduct research to improve a system for detecting clandestine nuclear tests in space.

The Telstar I communications satellite was "fixed" by remote control from the ground and then, a month later, it again succumbed to radiation encountered in space.

• Science News Letter, 84:389 Dec. 21, 1963

MILITARY SCIENCE

Plan Manned Orbiting Laboratory in Space

➤ MILITARY SCIENCE, already advanced far beyond the comprehension of most men, is about to enter another almost-fantastic stage with the Defense Department's newly announced Project MOL.

The MOL, which stands for Manned Orbiting Laboratory, would be the size of a housetrailer—big enough for astronauts to move around freely inside.

Potential military uses of MOL as indicated by military officials include:

1. Detection, identification or destruction of enemy spacecraft.

2. Command of strike forces stationed around the world.

3. Taking part in anti-missile defense.

MOL astronauts would be boosted off in a capsule similar to the one that will be used in Gemini rendezvous tests by a Titan rocket with two million pounds of thrust.

MOL is an Air Force project, separate from the National Aeronautics and Space Administration's moon-landing project Apollo. Instituting MOL means giving up Dyna Soar, a winged spacecraft that was to return to earth after a brief orbit.

Dyna Soar, short for dynamic soaring, was to have been a manned winged glider.

There are three military strategies behind manned orbiting vehicles that have been set out by defense officials. The first is the defensive approach involving anticipation of the nature of the military threat in space. The second, the deterrent approach, involves developing an advanced military space capability. The third stresses basic research toward to end of developing manned and unmanned military spacecraft.

• Science News Letter, 84:394 Dec. 21, 1963