

GENERAL SCIENCE

1959 Science Review

Hitting the moon and electronically photographing its hidden side were top achievements, as astronauts began training for space flights. New power sources explored.

This summary is limited by space to highlights, and credit to investigators and institutions is necessarily omitted. Most of the events are described in detail in the pages of SCIENCE NEWS LETTER for the current year. If you wish to refer to any particular report, you may find it readily through the index. (See SNL, June 27, and also the issue that will appear next week, Dec. 26.) If you want more information about any item in the summary, send 25 cents to help cover answering costs for each item upon which more information is requested.

By SCIENCE SERVICE STAFF

A GLIMPSE by rocketed instruments at the other, hidden side of the moon, discovering a new form of ancient man-like creature, attaching an image converter device to large telescopes to increase their effectiveness, synthesizing the largest protein molecule yet made, training space aeronauts—these are some of man's 1959 science and technical advances.

The competition between U. S. and U. S. S. R. technology and science continued unabated, with the Soviets ahead in space exploration due to their rocket shots around and hitting the moon, but U. S. rockets have put an increasing number of satellites into orbit, giving new information on natural radiation belts about the earth and other space conditions.

Nine new earth satellites launched by the U. S. A. were in orbit during 1959 and two U. S. space probes were successful, with Pioneer IV orbiting the sun and becoming an artificial planet. The U. S. S. R. Lunik was the first artificial planet, Lunik II hit the moon and Lunik III did a U-turn around the moon.

Seven young men went into training with the objective of being the first human beings to be transported into space and return to earth. The American astronauts are probably paralleled by similar Russian space men in training.

Before satellites containing pilots are launched, successful recaptures of capsules such as would be used must be achieved with a high degree of reliability. These tests began during the past year and will continue in 1960 and later until the apparatus and techniques are perfected.

For human-piloted flights closer to earth, the U. S. X-15 experimental rocket plane for high speeds at the top of the atmosphere made successful tests.

World travel entered the jet age on a large scale with 1958's inauguration of jet passenger service across the Atlantic being

followed in 1959 by jets around the world, clipping hours off the travel times between continents.

Although scientifically less important than many less spectacular achievements, the electronic photographs of the hidden side of the moon attracted major attention. Lacking the detail that is necessary for a determination of whether the unseen side is any different significantly from the familiar side we see, the pictures nevertheless show how rocketed instruments can explore outer space. Mars and Venus are space objects on the schedules of future flights.

Radar signals were sent round trip to Venus during 1959, and the use and new construction of giant radio telescopes for observing the natural radio emanations from space, continued.

Man has discovered much of the universe without traveling or sending instruments into space, and this older form of exploration continued with increasing results. The second largest telescope in the world, the 120-inch on Mt. Hamilton, Calif., went into service, with its perception augmented by an image amplifier, an electronic device that magnifies so effectively that it allows a telescope to perform as though it were many times as large. Just as improved photographic plates in the last decade achieved increased telescopic effectiveness, so the image converter allows an-

other step-up in reaching into astronomic space.

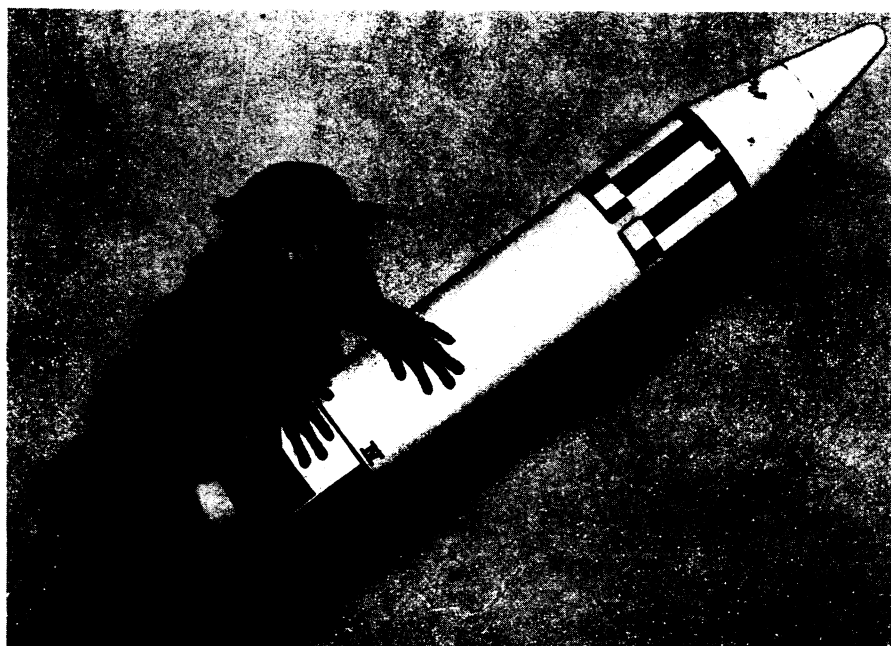
Electronics produced new devices and found added applications. The tunnel diode may ultimately replace the transistor in tiny radios and computers and maser amplifiers were found to be capable of operating at about 350 degrees below zero Fahrenheit. Light beams were magnified by using excited gas molecules in a maser-type device.

The practical control of fusion, the hydrogen-bomb reaction, for power purposes was not achieved as had been hoped, but progress was made in other methods of power production. Magnetohydrodynamics, in which an ionized gas moves in a magnetic field to make electric current, was demonstrated and a combination of large power companies entered upon practical development. Another source of electricity was developed in the form of fuel cells which were used to power a tractor, foreshadowing other automotive applications. Heat from waste atomic products was converted directly into electricity in another device.

The St. Lawrence Seaway, one of the great engineering feats of this era, was completed in 1959 and opened to ocean-going vessels. The use of hydrogen-bomb explosions for digging new harbors and other such engineering works continued to be discussed, but the prohibition of atomic explosions now in effect and being considered as a permanent international ban makes it doubtful that use will be made of atomic energy for such purposes.

The atomic power plants being built in various parts of the United States, England and Russia made progress toward completion, their future somewhat clouded by the

(Continued on page 413)



SPACE TRAVELER—One of the several monkeys in training for space flight is shown with a model of the missile used in U. S. space probes. Two monkeys were successfully recovered from a flight 300 miles into space, thus indicating the problem of re-entry has been largely solved.

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question as to whether their cost of power production can compete with favorably situated coal plants, and whether the disposal of radioactive wastes in the long run will prove more dangerous than anticipated in the beginning. The progress toward a nuclear-powered airplane in the U. S. or the U. S. S. R. was not clear, but possibility of a nuclear power plant for satellites and space vehicles came out of Atomic Energy Commission experiments.

The exploration of the earth begun intensively in the International Geophysical Year continued into 1959 and will extend into 1960 and beyond. Oceanographic research was emphasized and new research ships were authorized in the U. S. A. and the U. S. S. R. First steps were taken toward a probing of the interior of the earth, a project called Moho being planned to bore about five miles below the surface of the ocean to the Mohorovic discontinuity layer between the earth's crust and mantle.

Population Explosion

There was growing understanding of the danger of the population explosion that threatens the world as the result of medical advances that reduce the death rate and increased agricultural production that feeds and supports more people. The possibility of the development and application of practical methods of birth control emphasized the religious and social controversy which promises to continue.

Another ancient man-like creature arose out of the past, dug out of the earth in Tanganyika, East Africa, along with crude stone tools and animal bones. This creature who walked upright may prove to be important in the story of human evolution, which in 1959 received renewed attention because of the centenary of Darwin's "Origin of Species."

From the depths of the Pacific Ocean there came a rare "living fossil," a single-shelled mollusk called *Neopilina* previously believed to be extinct for 300,000,000 years.

The search for cures and methods of control of the unconquered diseases continued without spectacular "breakthroughs." Confident of the fruitfulness of the methods of research, more brains, human talent and money are being devoted to medical research, some of it applied and some basic.

Preventive Vaccines

In the case of several diseases, including syphilis and measles, there was some progress toward a preventive vaccine. Live polio virus vaccine was administered orally to many abroad, mainly in Russia.

Steady progress was made toward understanding the life chemicals, including DNA, for research upon which the Nobel Prize in medicine was awarded to two Americans.

The effect of radiation, which the atomic age has brought to the world in new extent, was the subject of continued study, one finding upon animals being that the brain is not unusually resistant to radiation as previously thought.

AERONAUTICS

X-15 Experimental Plane Tested in First Flight

The experimental plane, the X-15, designed to carry man to the edge of outer space, began its series of power test flights.

A traffic control computer was developed to prevent collisions between planes at take-off or in flight.

A jet bomber was safely landed by a ground-based, automatic landing system using radar to track the plane and radio to transmit flight path correction signals to the airplane's autopilot.

To test space survival equipment, a flyer jumped from a balloon at 76,400 feet, falling 12,000 feet and reaching a speed of nearly 450 miles an hour before his parachute opened.

A portable jet engine noise suppressor was developed for commercial ground maintenance engine run-up that can be used without modification on three different models of jet planes and reduces the noise level by 25 decibels.

Prototypes for aircraft maintenance shops, light enough so that the whole shop can be transported by helicopter and maneuvered on the ground by standard two and a half ton Army trucks, were developed.

A "sandwich" type metal paneling was developed for jet airplanes to stand 2,000-degree Fahrenheit temperature under severe pressure and thus to make possible speeds up to nine times the speed of sound.

A tiny device that super-cools infrared detection equipment, and thus increases its sensitivity, made possible detection of aircraft or missiles from a great distance.

New jet-engine fuels were developed that burn less brightly and develop greater thrust per gallon.

A new type of vehicle called the "Hovercraft" which travels, supported by air, a few feet above the surface of land or water was demonstrated as it crossed the English Channel.

A new parachute with four cloth blades that spin like a helicopter's rotor was designed to make paratroop drops safer.

Construction was started on a 40-inch hypersonic wind tunnel, the largest privately owned, that will provide testing capabilities up to 27 times the speed of sound.

A rocket-powered "aerial bobsled" emergency ejection seat to assure safe pilot bail-out in a feet-first position from supersonic jet interceptors and bomber aircraft was developed.

An aircraft designed to take off like a helicopter and then tilt its rotors to fly like a conventional airplane was flown successfully; it achieved 100% in-flight conversion at an altitude of 4,000 feet and a speed of about 132 miles an hour.

A new type of airplane powered by two fans enclosed in shells on its wingtips proved itself capable of vertical take-off and landing as well as forward flight.

A pourable synthetic rubber-based material that absorbs neutron radiation without damage and withstands extreme temperatures was developed as a lightweight shield for passengers on nuclear-powered aircraft and ships.

An easier, faster, cheaper way was found to calibrate airplane compasses; instead of turning the aircraft through a complete circle, an artificial magnetic field is electronically turned about the airplane.

The heaviest load in the history of aviation, 117,900 pounds, was lifted to an altitude of 10,000 feet by a U. S. military transport plane.

A vertical take-off airplane lifted a 100-foot long bridge at White Waltham, Berks., England, straight into the air, carried it three miles up river, and gently lowered it to span the river at a designated point.

A turboprop transport plane that can land

in 250 feet and clear a 50-foot obstacle less than 350 feet from the point of take-off completed successful test flights at Toulouse, France.

United States commercial airlines inaugurated domestic jet passenger service, expanded service to Europe, and began service to Hawaii and the Orient.

Russia's giant TU-114 turboprop jet plane, capable of carrying 180 persons, flew Khrushchev to the United States and was put into regular commercial passenger service later in the year.

Two U. S. space scientists measured "clear-air turbulence" at heights between 20,000 and 55,000 feet and concluded that jet airplane flights are smoother above 40,000 feet than between 20,000 and 40,000.

The first U. S. commercial jet maintenance center, described as the largest of its type in the world, started operation.

A new, easy-to-read altimeter was developed to make it almost impossible for a pilot to misread his flying height.

One of the first gas turbine engines designed especially for use in large helicopters and in aircraft for anti-submarine warfare was introduced by the U. S. Navy.

An atomic-powered blimp was proposed to the U. S. Navy to be made of a new rubberized fabric capable of withstanding radiation up to 100,000,000 roentgens; its reactor would have to provide only one-twentieth the power needed to sustain a nuclear-powered plane.

ANTHROPOLOGY AND ARCHAEOLOGY

Find Bone Fragments Of Very Early Man

Discovery was made in Olduvai Gorge in Tanganyika, East Africa, of fragments of the skull and shin bone of a man-like upright creature different from any form found before; the bone fragments, named by the discoverer *Zinjanthropus boisei*, were found associated with crude stone tools and remains of extremely large animals.

A mineral-coated human skull found at a depth of about 11 feet in the well of a Mexican farmer was judged to help bridge the gap between the mammoth-hunting Tepexpan Man who lived 9,000 to 10,000 years ago and the earliest farmers. The new find was a long-headed type and belonged to a food gathering economy.

A new method for dating ancient rocks, pottery ceramics and lava flows was developed based on heating a previously fired object and measuring its light glow and radioactivity.

Remarkably well preserved remains of a previously unknown pre-Aztec culture which flourished 1,000 years ago on Mexico's west coast were found at the mouth of the Santiago River in Nayarit and were studied by scientists of the University of California at Los Angeles.

Radiocarbon dating of ancient bones was made more accurate by use of the gelatin content instead of the carbon; the gelatin was found to be less likely to be contaminated with modern materials.

Small prehistoric stone tools known as burins, previously found only in northern regions such as Alaska, Oregon and Canada, were discovered in the Diablo Dam area near Del Rio, Texas.

American Indians were found to have lower serum cholesterol levels than the U. S. general population.

Aboriginal carvings made by the Kariera, a now almost extinct people, several thousand years ago along eight miles of limestone ridges in northwest Australia were studied by an anthropologist.

A 10,000-year-old village of round stone houses, established by a people who had not yet learned to grow food or domesticate ani-

imals, was discovered in the Hula area of Upper Galilee.

Two pairs of sandals found in different layers of refuse in Frightful Cave, in the state of Coahuila, Mexico, and radiocarbon dated showed that this cave was inhabited for more than 6,000 years; the older pair is 8,080 years old and the others about 1,770 years old.

A peculiar system of writing used on five atolls of the Central Caroline Islands, using a syllabary, not an alphabet, and two sets of characters having no resemblance to those of any other known system of writing was reported.

Wurm III, a geological period of intense cold lasting from about 25,000 years ago to 11,500 years ago, was of great importance to the history of mankind, it was reported; the cold sent the people of Europe fleeing for their lives, and the locking up of sea water in glaciers caused the shallow sea between Alaska and Siberia to be laid bare, permitting men and animals to cross into the New World.

Movement of people from the country to the city in Iran has brought about important changes in child care such as earlier weaning of babies and earlier removal of swaddling bands, it was reported.

The oldest known dated monument of the lowland Mayas, the date being equivalent to 32 A.D. by one correlation and 292 A.D. by another, was unearthed in Tikal, northern Guatemala.

ASTRONOMY

Moon's Far Side Photographed by U.S.S.R.

U. S. scientists welcomed the views of part of the moon's unseen side taken from a Russian satellite and radioed earthward.

Two different models of an image converter, a device to photograph stars electronically, were used successfully with U. S. telescopes, greatly increasing their effectiveness.

Radio astronomers from the U. S. made significant progress in their fight to prevent the use of frequencies by which they study the universe from being lost to commercial interests, and an international group met to decide frequency allocations on a world-wide basis.

Radar measurements of the moon's mean distance indicated that its center averages 238,856 miles from the earth's center and that the mean equatorial radius of the earth is about 3,986 miles.

Discovery that one form of technetium has a half-life as long as 2,600,000 years cleared up the puzzle of how technetium could exist in red giant stars.

Combining telescopic discoveries and new mathematical computations, an improved method of measuring the distances and brightness of certain hot stars called planetary nebulae was put into practice.

A new method for finding the mass of Mars was reported: a series of observations of the asteroid Laodamia when it makes a close approach to Mars.

The sun was photographed from an Aerobee-Hi rocket 123 miles up using far ultraviolet light and it was found that a very high percentage of Lyman alpha radiation comes from areas surrounding sunspots.

Studies of very distant galaxies by eight-color photometry made it possible to determine the red shift or speed of rushing away from the solar system considerably beyond the range that can be reached with the spectrograph.

Plans were made to measure the distance to the sun with much greater accuracy than formerly by using a radio telescope specially designed to tune in on radio waves absorbed by neutral hydrogen in interstellar clouds.

Study of comets can provide much insight into the origin of the solar system, it was reported; because comets are so cold, they probably have not undergone any extensive chemical changes since their formation from the original solar nebula.

Nitrogen tetroxide was discovered in the atmosphere of Jupiter and Venus by spectrographic studies of the planets' reflected sunlight.

The suddenly blazing light of a supernova may be due to the breakup of iron-59, it was proposed; this theory accounts for the observed rate of falling off of a supernova's light.

An extragalactic system was observed that appears to be either a new galaxy in the process of formation or the wreckage remaining after the collision of two galaxies.

The double star L726-8 was found to have a combined mass only 79-thousandths that of the sun and each of the pair has the smallest mass of all known stars.

By use of a large telescope erected on the moon, it would be possible to observe directly some planets of other stars, it was reported.

A "lost" meteor stream which gave the spectacular Andromedid shower in 1885 was rediscovered by astronomers but the density has declined from about 15,000 meteors visible hourly in 1885 to about one every five hours at the present time.

Observations of Jupiter's radio waves indicated that radiation far above the planet's surface is emitted by synchrotron action and is some 100 times more intense than earth's radiation belts; if so, Jupiter's magnetic field would be ten times stronger than the earth's.

The universe was reported to be at least ten billion years old, based on a new computed age for the Milky Way galaxy.

The sun reversed the polarity of its magnetic field during the period from 1957 to 1958, it was reported.

Galaxies in collision cause nuclear reactions resulting in the production of gamma rays that

could give information about the temperature and composition of the gas they contain, it was reported.

A rare celestial event, the passage of the planet Venus in front of a first magnitude star, was observed in Europe.

Neutral hydrogen gas was found to be very sparse in the space between galaxies if it is present at all.

U. S. scientists used a new kind of amplifier, the maser, and sophisticated new mathematical and electronic computing techniques to detect radar signals bounced from Venus.

The telescope blank for the new National Observatory's 84-inch reflecting mirror was cast and slowly cooled for seven months.

The 120-inch telescope at Lick Observatory on Mount Hamilton, Calif., second largest in the world, was dedicated and began its task of exploring the sky beyond a billion light years in space.

Discovery was reported that zeta Aquarii is a triple system, not a double star as previously thought; the small invisible companion has a mass about three-tenths that of the sun and revolves around the fainter star of the double system.

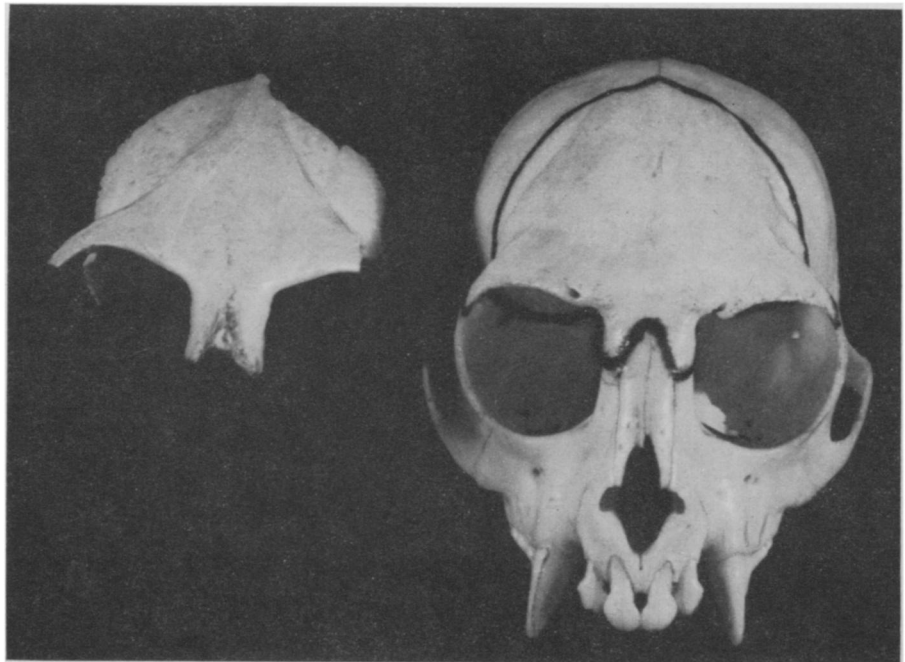
Two 85-foot steerable radio telescopes were put into operation, one at the University of Michigan and one at the National Radio Observatory.

A total eclipse of the sun occurred at sunrise on Oct. 2 in a narrow belt of eastern Massachusetts.

BIOLOGICAL SCIENCES

Analyze Mitochondria For Clue to Cell Energy

The membranes of mitochondria, microscopic bodies in the protoplasm surrounding the cell nucleus, have been taken apart and analyzed, establishing that they play an essential role in the exchange of electrons needed for energy storage and release.



ANCIENT BONE—The tiny primate bone fragment at the left, with the skull of a small monkey, the Golden Marmoset, next to it for comparison, has now been dated as being about 350,000,000 years old. This means it is part of one of the oldest specimens known of a higher primate, the group that includes man, monkeys and apes.

Complete synthesis of the iron-containing protein ferritin requires five and one-half minutes in the liver.

A rare "living fossil," a single-shelled mollusk called *Neopilina* previously believed to be extinct for 300,000,000 years, was recovered from the depths of the Pacific Ocean.

An Israeli researcher reported that studies of bloaters, or floating cucumbers, indicates that the inner tissue of normal, fresh, healthy fruit is not sterile, as previously thought.

Studies of the genes in corn indicate that these tiny determiners of heredity can be modified permanently by association with other genes.

The X chromosome was found to be three times the size of the Y chromosome.

A study of strontium-90 uptake by plants shows legumes take up from three to six times as much as grasses.

A dwarf virus, Phi X, has been found that has only one strand, not two, of DNA or deoxyribose nucleic acid wrapped in a skin of protein.

Soft tissues, such as tendon and skin, have been hardened into a bone-like material in the laboratory.

Mouse experiments show that nerve cells supposedly incapable of regeneration do exhibit nuclear and even cellular division.

Studies with the mold *Neurospora crassa* suggest that ribonucleic acid is a direct product of gene action, being formed in nuclei and later migrating into the cytoplasm.

Rare footprints of mammals of the Tertiary period were found high on a canyon wall along the Avawatz Mountains in the Mojave Desert.

A solid-image microscope has been developed that gives a three-dimensional view of the specimen being studied.

Luciferin, a light-emitting compound found in fireflies, has been removed for the first time from a fish, *Parapriacanthus beryciformis*.

A microbial insecticide, Thuricide made from the *Bacillus thuringiensis* Berliner, has been successfully tested on humans, plants and animals and found harmless to them all.

Serotonin and norepinephrine are two chemicals in blood that are essential to the mosquito and thus, it was reported, motivate the insect to bite.

A study of birds living near the equator shows they have their own reproductive cycle independent of the seasons, reproducing twice as often as other birds.

Improvements in plant breeding are expected with the development of a method for tagging potato plants that have half the normal number of chromosomes.

Bacteria resistant to radiation were found to be attracted by a negative electrical charge while normal bacteria are attracted by a positive charge.

A fluorescent labeling dye is used in a test that can successfully detect rabies in 15 minutes.

A synthetic culture medium was developed that will support growth of mammalian cells.

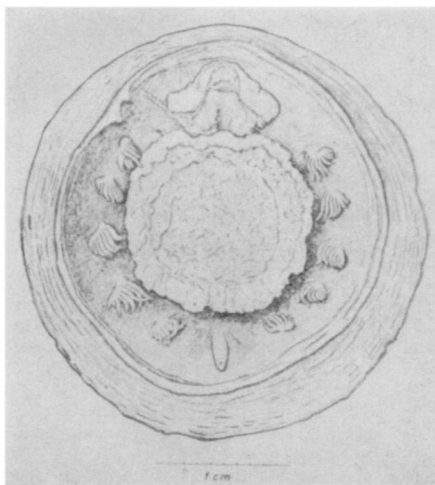
A tiny gland in the queen bee's mandible was found to be the source of an unknown substance, possibly a steroid, that apparently determines the social organization of the bee colony.

A mouse-sized treetop dwelling reptile, dated as living 200,000,000 years ago, was determined by new photographic techniques to be a reptile not an amphibian, as formerly supposed.

A parasitic evergreen shrub, *Podocarpus ustus*, was reported in New Caledonia.

Starvation was found to reduce the paramesium's sensitivity to radiation-induced mutations.

A new species of sea worm, belonging to the group Priapulidea, and usually found only at the poles, has been discovered in the deep ocean off Central America.



"LIVING FOSSIL" — The photograph shows a rare single-shelled mollusk called *Neopilina* previously believed to be extinct for 300,000,000 years. It was recovered from the depths of the Pacific Ocean.

A bone fragment from the skull of one of the higher primates was dated as 35,000,000 years old.

The insecticide DDT was found to be extremely hydrophobic, a characteristic scientists believe may explain why some DDT applications have failed to give effective results.

Living plants injected with human red blood cells have produced serum containing antibodies, a Yugoslav researcher reported.

The chromosome number for chickens, 12 for the male and 11 for the female, and new evidence of a reciprocal translocation or exchange involving the first and second chromosomes were reported.

Four-legged vertebrates acquired their sex-determining mechanism some 150,000,000 years ago, it was reported.

Israeli researchers reported success in desert farming using only salt water for irrigation.

Russian researchers reported success in making successive generations of wheat plants drought resistant by one soaking in water of young wheat seed.

The presence of a specific protein on the cell surface of one mating type of yeast and a polysaccharide on the cell surface of another type indicate biochemical differences as an explanation of mating in these plants.

The fossilized skull of fish of the *Albula oweni* species that lived about 50,000,000 years ago was found in England.

An unidentified "humoral factor" is believed to play a role in the formation of new lymphocytes, or white blood cells, from old ones that have disintegrated.

An unknown substance in kale inhibits germination of some plants and retards root growth, it was reported.

The chemical dimethyl sulphoxide was found to protect frozen red blood cells and other tissues from freezing-thawing damage.

The eye lens of a mammal can be used to determine the animal's age, it was reported.

An endotoxin released when blue-green algae decompose in farm ponds was found to poison livestock.

A powerful growth inhibitor, possibly naringenin, was found in "resting" peach flower buds.

CHEMISTRY AND PHYSICS

Plans Make Progress For A-Energy Control

The heads of the Russian and U. S. agencies concerned with atomic energy laid plans for closer cooperation between their countries in the development of peaceful uses for nuclear energy, including the possibility of controlling thermonuclear reactions, and the sharing of this research with the rest of the world.

Progress toward disarmament continued to be slow, although suspension of nuclear weapons tests by the U. S., U. K. and the U. S. S. R. was extended to the year's end.

The possibilities of international control of chemical, biological and radiological warfare were discussed at a Pugwash Conference by leading scientists, who urged that attempts be made to outlaw use of such weapons.

A new atomic method for amplifying light beams by using excited gas molecules in a maser-type device was reported.

A device, believed to be the first of its kind, was designed to measure the extremely weak effect of gravity waves when they strike an object.

A Federal Council on Radiation, to advise the President on radiation matters and to aid in the development of means for protecting persons from fallout and radiation, was set up by executive decree.

Scientists reported they had achieved a controlled thermonuclear reaction for a short fraction of a second in their laboratories.

The tunnel diode, which may ultimately replace the transistor in tiny radios and in computers, was produced in limited quantities for research.

A new table of abundances of elements, based partly on the thermonuclear reactions by which stars are stoked, was published.

Maser amplifiers capable of operating at temperatures some 60 degrees above absolute zero (about 350 degrees below zero Fahrenheit) were discovered.

Photographs showing anti-lambdas, particles of anti-matter, were taken in a new six-foot bubble chamber.

Molecules from space with the earmarks of chemical predecessors of the genetic material that makes life possible on earth were discovered in stony meteorites.

Two historic ship launchings were of the first nuclear-powered surface ship, the cruiser U. S. S. Long Beach, and the first nuclear merchant ship, the N. S. Savannah.

The shock waves that move at more than a million miles an hour from the sun to earth were duplicated in the laboratory, confirming a six-year-old theory that shock waves caused by solar flares bring the world-wide magnetic storms.

The major problem of disposal of atomic wastes was considered by a special committee of the National Academy of Sciences-National Research Council, which recommended procedures for safe disposal at 28 possible sites, and by a Congressional Joint Atomic Energy Committee subcommittee, which called for an imaginative yet realistic plan for disposal; the international aspects of the problem were emphasized in a five-point study plan presented to the International Atomic Energy Agency.

The xi zero, or neutral cascade hyperon, was detected, completing observation of the list of particles now predicted although a few predicted antiparticles remained unobserved.

A very small lack of agreement between the observed and predicted position of the planet Jupiter resulted in the suggestion that Newton's theory of gravitation, used to predict planet motion, may be wrong in some details.

Tracks of some of the very weak cosmic

rays that reach the earth's surface from space were photographed in a luminescent chamber for the first time.

The world's largest known bubble chamber for detecting nuclear particles, holding 150 gallons of liquid hydrogen, was successfully operated.

The U. S. accelerated its development of gas-cooled atomic power reactors by construction of an experimental pile fueled with enriched uranium oxide.

A theory was proposed that the secret of the structure of liquids is organized irregularity, with molecules coherently packed but without regularity.

The English-speaking nations adopted a new value for the international yard and pound, 0.9144 meter and 0.45359237 kilogram, respectively.

A pituitary hormone that causes skin darkening in humans and animals was synthesized, the largest protein-like molecule yet made by man.

A new energy range for studies of cosmic rays and the high energy particles produced in particle accelerators was opened by development of a specialized cloud chamber using a mixture of argon and helium.

An antibiotic having biological activity was synthesized, paving the way for future synthesis of man-made antibiotics that cannot be made from living organisms.

Nonuniform electric fields were tested as a new method of mixing or purifying liquids, powders, or mixtures of the two.

Direct conversion of atomic to electric power was achieved using a thermocouple composed of uranium and a gas, cesium.

Laboratory devices developed for direct conversion of electricity included an improved fuel cell that produces electricity directly from oxygen and hydrogen, and one that uses a gaseous fuel such as hydrogen or carbon monoxide fed continuously through the cell with an oxidizing agent.

Organo-metallic catalysts were found the keys to new plastics such as polypropylene and polybutylene that may surpass polyethylene.

Plastics uniting previously incompatible materials using a matrix of liquid epoxy resin were developed.

An organic solar battery containing alternate layers of organic dyes was developed in the laboratory, an outgrowth of studies on how plants store sunlight in energy-bearing compounds.

Plans were made to build somewhere on the Gulf Coast the nation's first saline water conversion plant, which may use a radioisotope heat source, and to locate on the West Coast an atomic-powered demonstration plant capable of converting 1,000,000 gallons of salt water daily.

President Eisenhower requested Congressional authorization for construction of a linear accelerator two miles long.

Two pressurized water reactors of the land-based prototype nuclear power plant for large naval surface ships operated at full power.

A spiral cloverleaf cyclotron, to be built by the University of California, was designed to give more power in a smaller machine than conventional cyclotrons.

A method of producing graphite in flexible fibers and woven fabrics was developed.

Copper oxide was found to be highly effective as a catalyst for breaking down two gases from automobile exhausts that produce much of the smog.

An international manual on the safe handling of radioactive chemicals for laboratories and hospitals was published by the International Atomic Energy Agency.

The Nobel Prize in Chemistry was awarded to Prof. Jaroslav Heyrovsky of Charles University, Prague, Czechoslovakia, for his inven-

tion and development of the polarographic method of chemical analysis.

Drs. Emilio Segre and Owen Chamberlain of the University of California were awarded the Nobel Prize in Physics for their discovery of the anti-proton.

ENGINEERING AND TECHNOLOGY

Extrusion Process Used For Bare Beryllium

Bare beryllium was successfully extruded.

The Dutch freighter Prins Willem George Federik was the first ocean-going vessel to reach a Great Lakes port through the new St. Lawrence Seaway.

An electric system was developed that generated 1,000 watts for five seconds using magnetohydrodynamics, in which an ionized gas moves in a magnetic field to make the current.

A 3,000-watt electric power plant driven by a 220-pound nuclear reactor was developed for use in future satellites.

A turbine-powered, diamond drill bored a 436-foot hole in the earth in 61½ hours, about twice as fast as conventional equipment and with a 30% drop in cost.

An electric tractor, getting power from 1,008 fuel cells under its hood, tugged a plow through packed earth with a 3,000-pound pull.

A one-kilowatt short-wave radio transmitter was developed to simultaneously broadcast two or more independent transmissions on different wavelengths.

An atomic "battery" was developed that can convert heat from waste atomic products directly into electricity by using the thermo-electric principle.

The U. S. Army began construction of a small atomic-powered town beneath the surface of the Greenland Ice Cap.

A distortion-free glass-making process was developed in England that avoids costly grinding and polishing steps.

A TV camera for viewing flaws in metals or for showing internal organs of medical specimens was developed that used ultrasonic sound, rather than light, for getting its picture.

A new design principle for radar antennas was found that may make it possible to detect enemy missiles as far as 3,000 miles away from U. S. shores.

A flat loudspeaker was developed in Israel that combines the virtues of a hi-fi set's tweeters and woofers.

The reactor for the second big U. S. atomic power plant went critical; peak power production of 180,000 kilowatts is expected from the Dresden station in 1960.

Russia began constructing 200,000-kilowatt nuclear power plants at Voronezh and Byeloyarsk.

The keel for the first U. S. nuclear-powered, guided-missile destroyer was laid.

A fast-developed, ultra-sensitive film photographed a flying spot moving over an oscilloscope screen at a speed of 98 feet per millionth of a second.

A process was developed to speed up production of molybdenum metal powder.

A magnetic glass rod, smaller than a pin, was developed to increase the "thinking" speed of electronic computers 10 to 20 times.

Heartbeat records were analyzed and diagnoses were made with the aid of an electronic computer.

Electronic computers were used to show how emergence of inherited characteristics can be predicted when fruit flies mate.

A machine that can read numbers printed in magnetic ink on checks and other documents, process these documents, then post them to the correct customer's account was introduced commercially.

An electronic computer began "learning" to translate Russian to English.

A computer translated French to English at a rate of three to four words a second.

Long glass fibers were given a special coating to make them a sensitive indicator of dangerous gamma radiation.

A new reinforced, but ductile, ceramic for rocket nozzles withstood the blast of a 5,000-degree-Fahrenheit engine exhaust.

A new ceramic was developed, made from aluminum oxide, that transmits light, is strong, can be pressed into any shape during manufacture, resists heat and is easy to make.

A dense, non-porous ceramic with a 5,000-degree-Fahrenheit melting point was made using 99.8% pure magnesia.

Flame sprays of ceramics and metals, first laminated on a rotating disk then crushed and hot-pressed, yielded a "cermet" material with resistance to both extreme heat and pressure.

A "continuous compaction" method was developed for pressing powders of ceramics and certain high-temperature metals into bars of unlimited lengths, the first step toward making a useful product.

Ceramic magnets, containing two metallic oxides, were developed that, for equal weights, have two to three times the power of iron magnets and retain their strength at high temperatures.

A flexible plastic was developed that can be magnetized in any direction and chopped into pieces without losing its magnetic properties.

Gold film, four-millionths of an inch thick, was found "unequaled" as a reflector of heat radiation when used on missile and aircraft sections.

A mechanical "sniffer" surpassed the human nose at distinguishing between types of whiskey, true and artificial flavors, good and bad essential oils, and cigar and cigarette smoke.

Pilot plant production was begun of synthetic quartz crystals that are free of optical faults often present in natural crystals.

GEOPHYSICS

Geophysics Cooperation Continues World-Wide

The International Geophysical Cooperation-1959, a world-wide cooperative effort by scientists following the 18-month International Geophysical Year, ends officially on Dec. 31, 1959, but the pattern of joint endeavor will continue in many geophysical fields.

A 12-nation conference agreed on a treaty for the peaceful and scientific development of Antarctica.

An international group under COSPAR established a code of conditions for landing objects on the moon and planets to keep contamination of the physical environment at a minimum from a scientific point of view.

A report by the Committee on Oceanography of the National Academy of Sciences—National Research Council warned that failure to double the intensity of deep sea research by the U. S. within ten years would lead to serious economic, political and military hazards.

Studies of the orbital path of Vanguard I showed the earth's sea level is 50 feet higher than expected in the north polar regions and 50 feet lower than expected in the south polar regions, giving it a very slight pear shape in addition to a bulging equator.

Lithium was discovered high in the earth's atmosphere, a finding believed related to nuclear tests.

A way of predicting weather patterns several weeks in advance, using an electronic computer and newly solved basic equations of atmospheric motion, was under development.

A mathematical model of the world's oceans

showed that the time needed for deep ocean water to renew itself is at least 300 years.

A blackout of radio communications, a visual aurora airglow and pronounced changes in the earth's magnetic field were among the results of hydrogen bombs exploded some 50 miles high over the Pacific; calculations based on high altitude nuclear tests showed that the ionized particles streamed along lines of magnetic force in a manner verifying theories.

An antipodal echo of satellite signals, coming from the side of the earth opposite to the satellite, was discovered and is believed due to unexpected ducting of the signals by the ionosphere.

A large nuclear explosion at high altitude could result in some permanent change in the earth's external magnetic field, observations of a man-made aurora resulting from such an explosion indicated.

Improvement of two seismic techniques will make it possible for scientists to detect underground nuclear tests at considerable distances, it was reported.

A relationship was reported between the long-period air circulation and surface temperatures of the ocean, a discovery enabling scientists to predict where warm, fish-containing waters will be found.

Launching of two satellites instrumented to yield cloud cover and radiation information, respectively, paved the way for future satellites that will give meteorologists a continuous timely picture of world-wide weather patterns.

Clear photographs of hundreds of miles of atmosphere were obtained by recoverable rocket-camera units designed to photograph cloud formations from extremely high altitudes.

Test soundings were made to study the feasibility of drilling a hole through the earth's crust and the Mohorovicic Discontinuity somewhere in the deep ocean.

Very intense and perhaps short-lived radiation thrown out by the sun during its periods of high activity was discovered, posing a possibly serious threat to manned space flight.

Increasing evidence was found that the earth is surrounded by a thick blanket of several natural radiation belts.

The earth is surrounded by an invisible halo of neutral hydrogen extending some 20,000 miles into space, theoretical calculations showed.

An earthquake of magnitude $7\frac{1}{2}$ shook the Yellowstone Park area on Aug. 17, caused great damage through landslides, and created a new lake.

Radioactive debris from hydrogen bomb tests spreads rapidly in the lower atmosphere, even crossing the equator, observations showed.

Forecasts of average temperatures for 50 specific cities within the U. S. were calculated routinely a month in advance using an electronic computer.

Discovery of a "hot spot" some 3,600 miles long on the floor of the eastern Pacific Ocean was reported.

A method for forecasting damaging sea surges at least two days in advance was developed.

The lowest temperature yet recorded on the earth's surface was reported to be 125.5 degrees below zero Fahrenheit in Antarctica.

U. S. research activities in Antarctica continued under the auspices of the National Science Foundation, and Russia announced plans to expand the scope of their explorations there.

Several discoveries increased the possibility that Antarctica may be divided in two: these include discovery of a sub-sea level trough trending inland from Ellsworth station, another trough on the opposite side of the continent trending inland from the Ross Sea, a deep basin in Marie Byrd Land, and an indication that the land mass is much smaller than its ice sheet cover.

The thinnest and thickest areas of the earth's

crust beneath the seas, four kilometers and 15 kilometers respectively, were found by seismic measurements at sea.

Seismic soundings in the Andes Mountains suggested that the lighter rock characterizing the mountains extends downward in a relatively fine network of supporting roots that penetrate the earth's crust deep into the mantle below.

The earth is covered with 40% more ice than was previously estimated, studies in connection with the IGY indicated.

Much valuable information about how electrons behave in the earth's magnetic field was obtained through Project Argus, the explosion of three small atomic bombs at an altitude of some 300 miles.

Temperature data obtained in Antarctica indicated confirmation of the world's long-term warming trend.

Bottom photographs of the Arctic Ocean showed an abundance of scattered rocks of all shapes and sizes, evidently carried hundreds of miles by floating ice.

In one layer of the ionosphere giant disturbances were discovered that stretch across at least 600 miles of sky at night as well as in the daytime.

The ionospheric D-layer becomes electrically conductive to a higher degree than normal at distances far greater than expected following hydrogen bomb tests at high altitudes, observations showed.

Establishment of a national institute to conduct basic research in the atmospheric sciences, to be operated by a group of universities and supported by the National Science Foundation, was proposed.

Experimental radar equipment was tested for spotting tornadoes through use of the Doppler effect.

The Weather Bureau continued its intensive studies of the structure, growth and paths of hurricanes, using three especially equipped research airplanes.

Jet age weather charts for forecasting flying conditions at levels between 20,000 and 45,000 feet were introduced as a daily transmission using a national facsimile network.

The Weather Bureau started issuing on an experimental basis a "discomfort" index, quickly changed its name to temperature-humidity index.

Seeding clouds with silver iodide strewn from airplanes may increase the chances of lightning in summer clouds over the Santa Catalina Mountains, it was reported.

The earth's core was reported to contain significant amounts of elements lighter in weight than iron, and its temperature was reported much cooler than has previously been estimated.

Invisible auroras that occur at the same times as unusual natural radio noises were reported due to the earth's encountering a stream of particles thrown out by the sun.

Sandstone-shale coal beds containing leaf fossils and petrified tree remains 12 feet long were discovered in the Horlick Mountains in Antarctica.

Radioactivity in the waters of the Pacific Antarctic is more than twice as great as the natural amount, a contamination believed due to fallout.

The sun's radiation bombarding the earth's outer atmosphere changes the density of the very rarefied air at altitudes of from 120 to 2,500 miles, observations of earth satellites indicated.

Duplication of the sun's radio amplification conditions was achieved in the laboratory without reproducing the sun's extremely high temperature.

Radio blackouts in polar regions were found to be due to abnormal numbers of free electrons in the D-region of the ionosphere as in-

dicated by telemetered data from two rockets.

F-region scatter of radio waves, discovered in the far Pacific with radio circuits between Okinawa and the Philippines, consists of clouds of ionization that are oriented along the lines of the earth's magnetic field to produce much stronger propagation than normally expected.

The electron density in the high ionosphere up to about 420 miles was measured by a new ground-based technique using a 2,000,000-watt transmitter and an antenna that covered four acres on the ground.

Night sky emission was found in the red at 6,300 Angstrom wavelength that appears to be in a band across the sky localized in middle latitudes.

Russian scientists reported the first measurement of a magnetic ring current around the earth at about 22,000 miles.

Scientists in the U. S. Navy's diving bathyscaph Trieste explored the Pacific bottom at a depth of 18,600 feet in the Marianas Trench off Guam.

By plotting earthquake waves, scientists drew the first generalized map of the U. S. without the earth's crust and found that its main features mirror those found on the surface.

Development of a cheap plastic rocket that could be fired daily by Weather Bureau personnel in large cities was foreseen after successful firings of the ARCAS rocket, a solid fuel rocket that can be launched by a two-man crew.

Wind speed and direction up to 10,000 feet above a watershed area were found to be the only values needed to determine the highest flows to be expected in rivers and streams, needed in building dams and planning for the multiple use of watershed areas.

MEDICAL SCIENCES

Live Polio Vaccine Used in U.S.S.R., Europe

The live polio virus vaccine attracted interest as more than 11,000,000 persons abroad, mainly Russians, received an oral dose.

In the 1958-59 season poliomyelitis cases showed an increase of 60% over the previous year and in the summer of 1959 the increase was even greater.

Strontium-90 levels in food samples taken by the Public Health Service across the U. S. gradually dropped after midsummer, official reports revealed.

Samples of alfalfa hay grown in the western U. S. indicate that 1958 experienced an extremely high strontium-90 level in certain sectors of the country.

The amount of radioactive strontium-90 deposited in the bones of children in the New York area in 1958 proved to be twice that of 1957.

Parents began mailing their children's baby teeth to scientists in St. Louis, Mo., who are measuring their absorption of radioactive strontium-90.

Radiation from carbon-14, by-product of nuclear testing, was found to be capable of causing significant genetic damage.

In tests necessary before manned space flight, the effects of cosmic rays, weightlessness, temperature and other space flight conditions were observed on two monkeys and other living organisms.

A new synthetic penicillin pill promised to make the penicillin injection obsolete.

BUDR, or 5-bromodeoxyuridine, reduced the amount of cancer-killing radiation needed to treat victims of this disease.

An anti-diabetic pill, DBI, or Phenformin, was developed especially for children.

An antibiotic was found in royal jelly, the

food fed by bees only to the insect destined to be the queen of the hive.

A new pain-killing drug, NIH 7519, or phenazocine, was developed that appears to be 10 times more powerful, less addicting and safer than morphine.

A newly recognized group of viruses was responsible for more cases of acute respiratory disease among hospitalized children than influenza was in 1957.

The muscle relaxant, zoxazolamine, was found to be useful in the treatment of gout.

A method of stimulating the heart through the jugular vein was developed.

Gonorrhea bacterium is becoming more resistant to penicillin, it was found.

A combination of mercaptoethylamine and cysteine protected 20 dogs from ordinarily lethal doses of radiation.

Seaweed extract was found to be an aid in the treatment of ulcers.

Scientists were able to prevent the death of experimental mice receiving live trachoma viruses.

A crude vaccine immunized 50% of a group of laboratory animals against syphilis.

A nine-year controlled clinical trial in England of the B.C.G. tuberculosis vaccine indicated that it does prevent tuberculosis in young people.

Plastic tubes were used to replace part of the conduction apparatus in the middle ear and ear drum punctures were closed with skin grafts.

A test was developed for detecting carriers of galactosemia, a rare but often-fatal infant disease.

High levels of cholesterol were found to be capable of preventing blood clot formations.

A measles vaccine made from live distemper virus proved effective among a small group of individuals.

A study was begun of 40,000 women who will be pregnant between 1959 and 1964 to study the causes of mental retardation and cerebral palsy.

A new drug, Mer-29, was found to lower cholesterol levels.

One kind of pigeon, the white carneau, with atherosclerotic lesions similar to those in humans was observed.

Changes in the large molecules in the body, nucleic acids, sugars and proteins or enzymes, were linked with inherited diseases.

Evidence was reported that confirmed that tiny spiral-shaped bacteria, called spirochetes, cause trench mouth in laboratory animals.

A strain of leprosy-causing bacteria was grown in tissue culture for periods as long as seven weeks.

A rare cancer tumor called chloroma disappeared when an anti-leukemic agent, thiopeta, was administered.

Irregularities in the number of chromosomes an individual has were linked to Mongoloid idiocy, abnormalities of sex organs, and leukemia.

Acetaldehyde, present in tobacco smoke, was held responsible for reducing longevity by stiffening connective tissue.

A system of balloons and tubes that circulates a cool liquid in the stomach halted severe bleeding of the small intestine.

A man was apparently cured of cancer after receiving blood from another man who had spontaneously recovered from the same type of cancer.

Studies indicated that triglycerides may be a cause of coronary artery disease.

White blood cells are full-size at first but grow smaller as they age, it was found.

EDTA, ethylenediamine tetra-acetic acid, was found to bring relief to sufferers of atherosclerosis, inability to move the skin.

An artificial bladder, the result of a new

surgical technique, was developed to carry urine to the outside of the body with full control in a normal manner.

Sound waves too high pitched to be heard by the human ear (ultrasonic waves) were found to stimulate gastric juice secretions.

A plastic resuscitator has been developed that is small and light enough to be packed in a beach bag.

It was found that the rate of death from cancer of the uterus has been cut almost in half within the past 10 years.

Monamine oxidase inhibitor relieved the pain of angina pectoris in 20 out of 43 trial patients.

A simple electronic device that can become fatigued and react in other ways similar to a tiny living nerve cell in the human eye and ear was constructed.

Plastic bags proved so dangerous to young children permitted to play with them or sleep on them that the Federal Government printed warnings in a new edition of the best-seller, "Infant Care."

Phosphorus in Texas corn and milk was found to prevent tooth decay.

Cold blood can now be pumped through the body, providing the surgeon more time to operate on the heart.

Allergic reactions to penicillin can be curbed by a new drug called Neutrapen.

A method of testing for pregnancy was developed that utilizes the hormone progesterone.

The basic structure of the polio virus was found to be spherical cluster of 60 identical units of protein.

Although vitamin E is necessary in the human diet, it was found that no special supplement is needed in the daily diet.

Statistics compiled during the year showed that the average weight of women has decreased while that of men has increased over the past 30 years.

The Nobel Prize in Medicine for 1959 was awarded jointly to Dr. Arthur Kornberg of Stanford University and Dr. Severo Ochoa of the New York University College of Medicine for work on DNA, important life chemical.

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PSYCHIATRY AND PSYCHOLOGY

Find Brain Sensitive To Radiation Exposures

The brain is not resistant to radiation, as once thought, experiments with animals showed.

Psychosurgery on mental patients was found to impair their intellectual ability when the patients were tested eight years after surgery.

The drug, serpatilin, a combination of tranquilizer and brain stimulant, gave hope for the improvement of severely retarded children.

Chemicals such as mescaline and LSD-25 (lysergic acid diethylamide) were used in tests with animals to study why the mentally ill and fever patients have hallucinations.

Persons born deaf were found to have vivid dreams in color and 3-D, using sign language for communication; dreams of those with acquired deafness lack color, vividness and sign language.

Hallucinations may be caused by chemicals called psychotogens, produced by the brain, which disrupt communication between the parts of the brain that handle information, experiments showed.

Persons were found to see hallucinated images of themselves when depressed and without motivation to live.

Many emotional illnesses were reported to be at least partly the results of a person's "quest," or need for certainty.

Newborn infants were found to have ability to see motion it was previously thought to take six months to acquire.

Babies, it was shown, can perceive depth as soon as they can crawl.

The effects of isolation on the mind are not easily recovered from after release from the isolation, experiments with animals showed.

Crews of a nuclear submarine stood up well under the stress of being submerged for 60 days.

Space travelers who lack warm human relationships will be able to survive best the barren loneliness of space, it was predicted.

Solitary confinement, one of the methods of "brainwashing," made white mice and rats go "stir crazy."

Mice became agitated and neurotic when kept in solitary confinement, similar to the conditions in space travel; it was then possible to use them as laboratory animals to test tranquilizing drugs.

Isolation in the Antarctic was found to produce anxiety, sometimes triggering psychoses; work was found to be a remedy.

Parents of a mental patient suffering from schizophrenia were observed to be so distant toward each other that they have what amounts to an "emotional divorce;" the mother and the patient form an "intense twosome" while the father permits himself to be pushed aside.

Some types of mental deficiency caused by defects in body chemistry were alleviated by corrective diets.

A case of addiction to the fumes of gasoline was observed in a 12-year-old boy.

Psychiatric interviews and test ordeals showed the seven young men chosen as candidates for space travel to be intelligent, mature and well-integrated persons.

Deafness was found to lower a person's score on the Rorschach ink-blot test of personality.

The Rorschach personality test was found to give a clue to which suicidal mental patients will later succeed in killing themselves.

Some suicide cases are actually victims of "psychic murder," they are driven to suicide by the unconscious wish of someone close to them, it was found.

More than one-fourth of the cases of murder in a five-year period in Philadelphia were considered as a form of suicide with the murdered bringing the killing on himself.

Taken in combination with the tranquilizing drug chlorpromazine, as little as one drink of liquor makes it dangerous to drive a car or operate complex machinery, it was found.

Juvenile delinquents from wealthy families were found usually to have aggressive, perfectionistic, rigid, or indifferent fathers and over-indulgent or inconsistent mothers.

Murder by children between five and 15 is often due to mental illness, it was reported; many such children had been seen by psychiatrists and dangerous behavior had frequently been predicted.

"Subliminal perception" of an object displayed too briefly for him to be aware of it affected the heart of a monkey though his outward behavior was not changed.

Although the heart beat is involuntary, human hearts were conditioned to beat faster in response to certain signals.

It is possible to be conditioned to avoid an annoying noise without being aware of your action, it was reported.

An attempt was made to develop a method of immunizing against persuasion by gradually building up a resistance to propaganda.

Artificial signals used to break up long intervals between real signals increased the efficiency of lookouts.

The way a person grasps a door knob can disclose whether he has an aggressive or submissive personality, it was found.

Conditioning of baby goats supported the theory that people's nervous and emotional problems often stem from painful experiences during the first weeks of life.

Men who get duodenal ulcers early in life tend to have dominant and overprotective moth-

ers who over-indulge them and fathers who are submissive, it was reported.

Many schizophrenic children show no pain when hurt, as does the normal child, it was reported.

Development of the baby gorilla was found to be much more rapid at first than that of the human infant, but the human baby continued to develop long after the gorilla stopped.

Sharks were conditioned to press a target in order to get their dinner, and the conditioned response was retained after an interval of 10 weeks without practice.

Rats were found to be able to keep themselves warm in cold weather by learning to press a lever to turn on heat.

A monkey is able to communicate useful information to another monkey, tasks requiring the cooperative action of pairs of animals demonstrated.

ROCKETS, MISSILES AND SATELLITES

U.S. and Russia Send Many Satellites Up in '59

1959 Satellites launched, showing vehicle, its lifetime and purpose.

PROJECT SCORE, USA, Dec. 18, 1958, to Jan. 21, 1959; broadcast President Eisenhower's Christmas message.

VANGUARD II, USA, Feb. 17 to 1969 (est.); scanned earth's cloud cover with photocells.

DISCOVERER I, USA, Feb. 28-Mar. 5; checked rocket propulsion guidance, staging and communications.

DISCOVERER II, USA, April 13-26; carried radiation and life-sustaining experiments.

EXPLORER VI (Paddlewheel), USA, Aug. 7 to over year (est.); TV cloud cover scanning, experiments measuring earth's radiation, micrometeorites, earth's magnetic field, and behavior of radio waves.

DISCOVERER V, USA, Aug. 13-Sept. 28; carried 310-pound re-entry capsule which was not recovered.

DISCOVERER VI, USA, Aug. 19-Oct. 20; same as Discoverer V.

VANGUARD III, USA, Sept. 18 to 30 to 40 years (est.); experiments measured earth's magnetic field, solar X-rays, space environment.

EXPLORER VII, USA, Oct. 13 to 20 years (est.); weather research, earth's radiation balance, space temperatures, special transmissions for ionospheric research.

DISCOVERER VII, USA, Nov. 7-; carried 310-pound capsule believed not ejected.

DISCOVERER VIII, USA, Nov. 20-21; same as Discoverer V.

1959 Space probes:

PIONEER III, USA, Dec. 6-7, 1958, climbed 63,580 miles, discovered second radiation belt around earth.

LUNIK (Mechta), USSR, Jan. 2, 1959; orbiting sun on 15-month cycle, measured radiations, magnetic fields and interplanetary matter in space. Became "Artificial Planet I."

PIONEER IV, USA, Mar. 3, now orbiting sun; passed moon at 37,300 miles; measured radiation in space. Became "Artificial Planet 2."

LUNIK III, USSR, Sept. 12-13, traveled 236,875 miles and hit moon near Sea of Tranquility.

LUNIK III, USSR, Oct. 4, did U-turn around moon, radioed back first picture of moon's far side.

Seven officers of the Navy, Air Force and Marine Corps, mostly in their early 30's, were chosen to be trained as America's first astronauts.

A military test crew successfully test-fired an operational-type Atlas intercontinental missile which the Air Force was expected to declare operational by the end of the year.

A network of radio stations that can find and track silent and perhaps dangerous reconnaissance satellites was established across the southern United States, as a protective measure.

A chameleon-like coating that changes color as temperature varies was developed to keep satellite temperatures relatively constant.

A satellite with a built-in meteor trap to detect tiny particles in space was designed.

A prepackaged liquid rocket engine, combining advantages of the liquid bi-propellant engine with the safety and handling ease of solid propellants, was successfully fired.

A super-sensitive instrument to detect missile fuel leakage was developed; it can sniff out leaks so small that more than a year would be required for 1/100 ounce of gas to escape.

Scientists harnessed the brief, powerful shock wave generated when a strong electric current is discharged through air in a cylinder—presaging a plasma engine that some day may power a space ship to carry men to Mars.

Two monkeys were blasted 300 miles into space and recovered from the Jupiter intermediate-range ballistic missile's nose cone; their safe recovery indicated that the problem of re-entering the earth's atmosphere is solved.

One of two monkeys successfully recovered from a 300-mile flight into space later died during a minor operation, apparently victim of an uncommon anesthetic reaction.

Russia claimed development of an underground rocket for burrowing holes in the earth.

An escape capsule for Mach 2 and Mach 3 airplanes was disclosed that rockets a pilot safely out of a disabled plane in two seconds.

At least three heat shields were developed for possible use on the Mercury capsule that will carry the first U. S. astronaut into space; one was a three-inch-thick beryllium plate with a vast heat-storage capacity, and the others were made of ablating materials that heat up and disintegrate under atmospheric friction, thus carrying off heat.

A project to deliver letters via guided missile



MAN-CARRYING MERCURY — Capsule for space is being tested in model form at 20 times the speed of sound. The airflow becomes incandescent during the brief test run, simulating in the U. S. Air Force's Arnold Engineering Development Center air tunnel the reentry into the earth's atmosphere of the space vehicle.

between Genoa, Italy, and Hamburg, West Germany, was proposed.

Research began on a plan by which a satellite-launching vehicle can be put in a "parking orbit" around the earth until it reaches a point most favorable to its mission, at which time it would blast off into space.

Tests were started to determine whether high-velocity plasmas can be slammed together to produce high-powered radio waves suitable for space communications.

A small-scale experimental ion engine was developed that may lead to big engines for interplanetary space vehicles.

A recording-rebroadcast system was developed to overcome the brief radio blackout that blocks transmission of scientific data when a missile re-enters the atmosphere.

Using data radioed from earth satellites, scientists began charting the "weather" of space, including streams of nuclear particles, and protons.

The first crude picture of the earth's cloud cover was transmitted by radio from Explorer VI satellite.

An optical tracking station at Woomera, Australia, successfully photographed Vanguard I earth satellite at its 2,500-mile apogee, its farthest orbital point from the earth.

A new panoramic camera was made that could be used for moon exploration via satellites.

A nine-pound battery-powered TV system was developed to send clear pictures back to earth when rocketed 1,000 miles high.

The Air Force disclosed that it was developing a supersensitive radar that can "talk" to an intercontinental missile to keep it accurately on its target course.

Work on a three-dimensional radar was revealed that will be linked to a data processing computer to spot "targets" in the sky and predict their exact position for a few moments later, being able to follow hundreds of targets simultaneously.

A new automatic all-weather landing system for use aboard aircraft carriers landed the Regulus II surface-to-surface guided missile in at least two tests at an Air Force base.

A new Mark IV space suit was perfected that may be used by the first U. S. astronaut.

Explorer VI was equipped with an automatic cutoff for its broadcast signals, the first time any earth satellite was so equipped.

Air-drag fins that spring out at just the right moment were revealed as the heart of the solid-fueled Sergeant artillery missile's pinpoint accuracy.

Packaging special fuel additives in pills, to give extra thrust, was suggested as a remedy for costly corrosion in liquid and solid rocket engines.

A new solid propellant was developed to withstand high temperature storage and give less variation in performance as its temperature changes.

It was found that boron-oxygen-hydrogen-type molecules remain stable at high temperatures, possibly leading to more accurate thrust predictions for boron-fueled rockets.

A contract was let for development of a bi-propellant, single-chamber rocket engine having 1,000,000 to 1,500,000 pounds of thrust, and the first version of the engine underwent static tests.

A nylon-net space suit, resembling long underwear laced with steel cables and tightened about the wearer by a hydraulic system, was designed to hang suspended like a hammock in seatless cockpits of future space ships to keep astronauts from floating about on gravity-free flights.

Tests on aluminum rocket cases reversed the notion that aluminum could not contain the riot of forces in a solid-fueled rocket motor.

(Continued on page 421)

PATENTS

**Major Patents in 1959
Cover All Sciences**

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

A method of recording and broadcasting insect sounds for the purpose of attracting the pests to their destruction. Patent 2,861,132.

An apparatus that controls the temperature inside a building in accordance with changes in outdoor temperature, offering thermostatic control of air, water or steam heat, Patent 2,862,081.

A speech aid that may serve as a substitute for the vocal cords of persons such as those who have undergone surgical removal of the larynx. Patent 2,862,209.

A coupling device that makes it possible for a bomber plane to carry a fighter plane at the end of each wing, making it possible for a bomber to carry its own fighter escort. Patent 2,863,618.

An iron, either steam or dry, that floats on a cushion of compressed air, never touching the garment being pressed. Patent 2,864,185.

A device using bursts of audible sound to detect depths, contours and densities of sub-surface geological formations. Patent 2,866,512.

A method of recovering scrap titanium and using it to make electrodes for titanium ingots vital to the production of supersonic aircraft. Patent 2,867,895.

A jet-propelled airplane capable of vertical take-off with an undercarriage mechanism that will support it in either a horizontal or vertical position. Patent 2,868,477.

A method of soldering electrodes to semi-conducting crystal elements, such as germanium, that is done in an inert atmosphere without the use of a flux or intermediate metal layer. Patent 2,867,899.

A man-made ionosphere, consisting of small artificial clouds of reflective materials, to provide a better reflector for radio waves in long-distance communications than the natural ionosphere. Patent 2,871,344.

A surgical training apparatus, simulating various parts of the human body, for use in training advanced first-aid students, doctors and nurses in the treatment and closure of wounds. Patent 2,871,579.

A fluid-packaging method that eliminates the need for making the carton leakproof and the risk of having chunks of the container coating contaminate the contents. Patent 2,872,760 for the packaging method and Patent 2,872,766 for an apparatus embodying use of the method.

A deep-sea cable with an insulation of such tensional strength that it can replace conventional outer armoring. Patent 2,873,307.

Form-fitting foam, generated from a solution of water, saponin and any of a large number of long-chain polymers, for spraying over delicate fruit trees and plants to protect them against frost damage. Patent 2,875,555.

A two-way television communications system that allows both parties to see and hear one another during a regular phone conversation. Patent 2,878,310.

An automobile engine that operates more economically on only half its cylinders under certain conditions, such as cruising at a steady speed. Patent 2,878,798.

A system, consisting of electronic gates, for eliminating "ground clutter," one of radar's chief disadvantages. Patent 2,879,504.

A paint of high electrical resistance and capa-

ELECTROSTATIC GENERATORS

(Van de Graaff Type)



500,000 VOLTS. This model available in kit form is over 3 feet tall and has a 15" diameter spherical charge collector. Kit includes 15" hemispheres, plastic tube, pulleys, bearings, belt, frame, and assembly directions.

\$31.50 Postpaid

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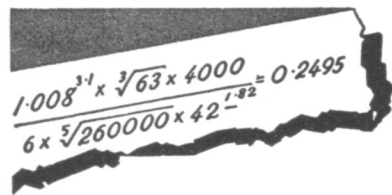


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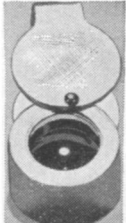
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Questions

EVOLUTION—How has weeping contributed to the evolution of man, according to one anthropologist? p. 412.

MEDICINE—What two compounds are used in a new cancer treatment? p. 410.

TECHNOLOGY—How high a temperature can Pyrographite withstand? p. 422.

Photographs: Cover, Raytheon Company; p. 410 and 411, U. S. Army; p. 414, Princeton University; p. 415, Columbia University; p. 419, U. S. Air Force; p. 424, Westinghouse Electric Company.

1959 Patents Reviewed

(Continued from page 421)

ble of generating large amounts of heat when connected to an electric circuit. Patent 2,883,307.

An aircraft engine that operates as a rocket on take-off and converts into a ramjet for sustained flight, designed for use in piloted aircraft and medium- and long-range ground-to-ground missiles. Patent 2,883,829.

An electrical device for detecting hidden crevasses in glacier ice. Patent 2,885,633.

A packaged, inflatable airplane, with a two-cylinder, 40-horsepower engine, that can be parachuted to pilots downed behind enemy lines. Patent 2,886,265.

A method, using hydraulic resonators, for inducing the waves of the sea to calm themselves with their own energy. Patent 2,886,951.

A navigation system, involving measuring magnetic inclination and declination, that enables a person to determine his position above, on, or under the surface of the earth without the aid of radio signals or astronomical readings. Patent 2,888,752.

An inflatable radar antenna that can be easily transported and assembled in a matter of minutes. Patent 2,913,726.

A method of laboratory isolation of elusive free radicals, opening the way for probing the basic atomic structure of solids. Patent 2,892,766.

A boat for navigating Arctic waters that can hop up on an ice floe, travel across the ice, and return to the water. Patent 2,894,476.

An improvement in electroluminescent lighting, increasing the light output fourfold. Patent 2,901,651.

A way of coating metallic aluminum with an aluminum benzoate film to protect it from oxidation. Patent 2,901,821.

A plastic explosive consisting of nitric esters, nitrocellulose, nitrostarch, crystalline explosives and a silicone gel. Patent 2,902,355.

Application of zinc oxide and small amounts of manganese dioxide to unfired bricks to produce unusual final colors in the bricks. Patent 2,903,785.

An improved method of prospecting for minerals from the air, involving the use of at least two radiation detectors flown simultaneously at different altitudes and at substantial distances from one another. Patent 2,904,691.

A method of forging pure titanium and alloys containing at least 80% titanium without the fear of forming contaminated surface layers of brittle oxygen-nitrogen compounds. Patent 2,903,785.

A recovery process for extracting oil from oil-bearing sands and shales using a combination of hydraulic mining and aerobic bacteria. Patent 2,907,389.

A universal clock that tells the correct time and date, the hours of daylight and darkness, and the hours of sunset and sunrise of any place on the globe. Patent 2,907,166.

A way to determine the relative speed and direction of a plane in flight, using the well-known Doppler effect. Patent 2,908,903.

An eraser attachment incorporated into the mechanism of any conventional typewriter. Patent 2,908,372.

An Arctic life raft for use on water, land, snow or ice that also serves as an insulated shelter. Patent 2,908,919.

A method of cladding steel with corrosion-resistant metals, such as titanium and zirconium, by using an intermediate layer of a bonding metal such as chromium, cobalt or molybdenum. Patent 2,908,969.

Science News Letter, December 19, 1959

TECHNOLOGY

Unusual Form of Carbon New Material for Missiles

See Front Cover

A NEW form of carbon, Pyrographite, has been developed by the Raytheon Company, Waltham, Mass., sponsored by the Navy Bureau of Ordnance, as a possible answer to some of the problems in missile construction.

The material, a high purity form of graphite, withstands temperatures up to 6,700 degrees Fahrenheit, higher than any other known element, and remains strong, chemically inert, and impervious to gases.

The secret of its great heat stability is that heat is conducted along its surface 500 times better than through it, thus preventing any excessive build-up of heat.

The photograph on the cover of this week's SCIENCE NEWS LETTER shows Pyrographite material (left) withstanding the blast from a butane torch while the same blast burns through asbestos (right).

Science News Letter, December 19, 1959