

GENERAL SCIENCE

# Science Review for 1947

Nature of smell, change of proton to neutron, printed circuit radio and man-made rain are among the most important discoveries of the year.

*This summary of the year's happenings in the world of science is limited by space to just the highlights. Most of the events are described in detail in the pages of the 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 28 and also the issue which will appear next week, Dec. 27).*

## By SCIENCE SERVICE STAFF

► DISCOVERY that the sense of smell operates through odoriferous substances filtering out heat rays inside the nose may be ranked in future years as the top science achievement of 1947.

The successful use of streptomycin against some kinds of tuberculosis was an outstanding medical advance, while the outbreak of cholera in Egypt was a warning that epidemics are still a world menace.

In aviation, the push-button Atlantic round trip of a plane unpowered by human hands gets top billing, while the trial flights of jet-propelled bombers of great size and the undoubted but unannounced advances in guided missiles of a major sort are important military science developments.

Sunspots were more plentiful than they have been for 100 years and their cycle came to a peak. The great mirror of the 200-inch telescope was carried to Mt. Palomar, Calif., and soon will see farther into space.

Artificially-made long chains of protein molecules gave promise of new developments in medicine and plastics, possibly explaining some living mechanisms.

In the new highest voltage atom smasher at Berkeley, Calif., proton and neutron were turned one into the other; a new array of light isotopes were created and new elemental transmutations accomplished.

Evidence grew for existence of man in America 10 to 20 millenia ago, and a 10,000-year-old human skeleton was found at Tepexpan, Mexico.

Radio sets, hearing aids and other electronic devices using war-developed miniature tubes and printed wire circuits appeared.

Man made rain on a limited scale by

sprinkling solid carbon dioxide or even water on clouds, and hope increased that something might be done about the weather.

Disordered agricultural production and crop failures, including the bad USA corn year, caused a world food crisis. Foot-and-mouth disease in central Mexico posed the most serious menace to livestock in North America.

Military applications of science in the unified defense establishment were reinforced and accelerated by a new research and development board, while the civilian national science foundation again failed to be created.

## AERONAUTICS

### Plane Crossed Atlantic Without Hands at Controls

PUSH-BUTTON flying enabled an Air Force plane to cross the Atlantic and land without human hands touching the controls.

New official world record of 650.6 miles per hour was set by Navy pilot flying a Douglas Skystraker; an Air Force B-29 Superfortress flew 8,854.8 miles to beat the international closed course distance record.

Speedy Navy transonic Skyrocket plane, powered with both turbo-jet and rocket, was designed to fly 760 miles an hour.

A flying-wing Air Force bomber, with eight jet-propulsion engines and without tail or fish-shaped body, flew successfully.

An engine trouble analyzer was developed to enable the engineer to locate during flight improper operation that might cause engine stoppage.

Photoelectric instrument was developed to record automatically the cloud-height over airports; visibility-measuring device was designed to aid landings at airports; portable device accurately indicated wind speed and direction, important in airplane take-off.

Very high frequency navigation receivers for airplanes were developed for use with VHF radio ranges, static-free guide paths to their destinations.

Two new devices showed tower-control operators the exact position of an approaching plane and its altitude; fog dispersal system was used to aid instrument landing systems; television and radar were combined in an aircraft navigation and landing aid; 15-pound radar equipment warned pilots of too close approach to earth.

Lights producing flashes strong enough to penetrate any weather for at least 1,000 feet were developed to aid airplane landings; lighting system for small-town airfields was made to be moved with change in the wind.

Two supersonic wind tunnels were com-

pleted to create conditions met at altitudes of 50,000 feet to 100 miles; system of 10 chambers was devised for studying the effects of weather on aircraft accessories; hangar that simulates extreme weather conditions encountered in operation was developed for testing new aircraft and equipment; air eddies were eliminated in wind tunnels by use of improved fine screens.

One-ton monoplane for Army liaison work, designed to clear a 50-foot obstacle within 600 feet of take-off, has a passenger-carrying boat-shaped body for pilot and observer suspended below the wings and forepart of the boom.

Glider that discards wings and tail when it lands upon the water, and like a motorboat is powered by a small gasoline engine, was designed for use in shipwreck rescue.

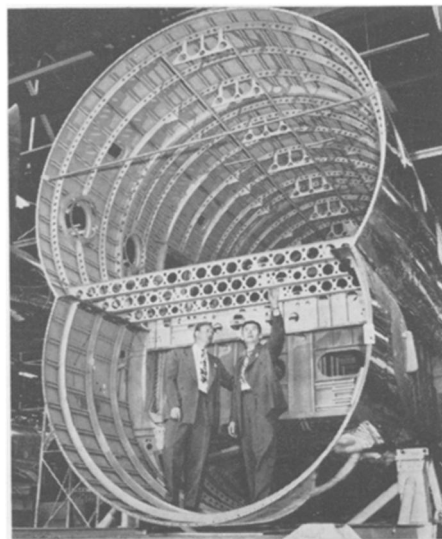
The Air Force XB-47, a six-jet engine bomber, incorporates swept-back wings and tail surfaces that are ultra thin.

Speedy combat aircraft, Navy XF2R-1, has a gas-turbine engine in front and jet-propulsion engine in the rear.

Men cleared the tail of a speeding jet plane by being shot from the cockpit at a velocity of 60 feet per second.

Parachute of criss-crossed wide fabric ribbons safely lowered to the ground a jeep and howitzer at the same time.

A tractor-track of the endless belt type, installed on the landing gear of heavy Air Force cargo planes, was found practical for landing on soft dirt, mud or sand; inter-



**TWO-STORY AIRLINER**—Shown in the process of construction is this 67½ ton sky giant, the Boeing 377 Stratocruiser. A fleet of these will be used for 340-mile-an-hour coast-to-coast and Pacific Coast-Honolulu service. Accommodations for 55 passengers will include stateroom and sleeper facilities, lounges, food galley and bar. It will also carry 8,000 pounds of cargo.

changeable landing wheels, skis and floats permitted a plane to land on earth, snow or water.

Air Force helicopter with overlapping rotors was designed to carry pilot, co-pilot and 10 passengers; Navy 10-passenger helicopter, with fore and aft rotors, was accepted by the Service.

The Banshee, powerful single-seat Navy fighter capable of flying 600 miles per hour and climbing 9,000 feet per minute, successfully passed flight tests.

Airplane noise nuisance was decreased by use of propellers with an increased number of blades rotating at lower speeds than usual.

Transcontinental Racon-route, system of short-range aerial navigation utilizing radar, was installed to enable pilots on the route to determine their exact positions at all times.

Air Force XC-99, designed to carry a load of 100,000 pounds or 400 passengers, passed ground tests.

Hughes' giant eight-engine flying boat, with a wingspread of 320 feet, made successful flight.

Engine exhaust gases, which contain too little oxygen to support combustion, were successfully used in the vacant spaces inside and around fuel tanks as fire protection.

Glass that conducts electricity, and thus can be electrically heated to keep it free of ice, was installed in control cabins of the giant Stratocruiser.

Helicopters were put into regular service to shuttle passengers from suburban cities to mainline airports used by long-range transports.

Flying tanker refueled an airliner in flight within 20 minutes in attempt of British to extend range of airliners.

#### ANTHROPOLOGY AND ARCHAEOLOGY

### Ancient Javanese Skull Collection Now Complete

COLLECTION of 11 fossilized human skulls, at least four times as thick-walled as modern man's, representing a people with bulging beetle brows who lived in Java over a third of a million years ago (*Homo soloensis*), was made complete with return of one missing member taken as war booty just after their discovery.

Almost complete lower jaw of a large ape-man with incipient chin, oldest human-like skull with stuck-out chin, was found in a cave at Sterkfontein in South Africa near skull of toothless elderly female, lacking lower jawbone, with brain capacity about equal to those of present-day large apes and only a third that of modern humans.

Crude stone implements unearthed in Nebraska associated with animal bones suggested that men camped there 20,000 to 35,000 years ago; no human skeletal remains were found.

Remains of America's earliest known human being, with age estimated at 10,000 to 15,000 years, were discovered in Tepexpan, Mexico, through use of geophysical prospecting methods, and brought to Washington for restoration.

Discoveries at Mersin in southeastern Turkey showed a chalcolithic or "copper" age transition period from late stone age to bronze age.

Monumental architecture from early prehistoric ages, probably well before 3,000

B. C., was found in southern Iraq at the site of Abu Shahrain excavations.

Complex structure assumed to be the burial place of a Hittite king, containing evidence of elaborate funerary rituals, was investigated at Tell Atchana in the Hatay area of Turkey.

Eleven heretofore unknown Mayan temples, dating from 495 to 672 A. D. and regarded by archaeologists as most complete find of recent years, were discovered.

Indians with features characteristic of the general American Indian neighbors of first New England settlers were reported living on Martha's Vineyard island off southern coast of Massachusetts.

U. S. Government entered archaeology on a national scale by initiating a survey of all archaeological sites on rivers where dams are to be built or other major changes undertaken.

#### ASTRONOMY

### Find Sun Has Regions of Unsuspected High Energy

BROAD, fuzzy absorption line of the sun's spectrum was found to be identical with the red "coronium" spectrum line seen during solar eclipse; this indicated that the sun has regions of much higher energy than previously suspected.

A gigantic sunspot, easily visible through smoked glass, lived to be seen during four rotations of the sun; more sunspots were seen during May than in any month for more than 100 years.

Light and dark patches bearing some resemblance to sunspots were observed on a distant star; this is the first time surface features of any star beyond the solar system have been reported.

Mars' atmosphere contains an appreciable quantity of carbon dioxide, even a larger percentage than is in the earth's atmosphere, spectrographic study of infrared sunlight reflected by the planet indicated.

New comets Rondonina-Bester, Becvar, Bester IV, Jakovin, Wirtanen, Reinmuth, Bester V, Honda and 1947N were discovered; comets Grigg-Skjellerup, Faye, Whipple, and Encke were rediscovered.

Giant 200-inch disk, successfully ground, was moved to Mt. Palomar to be installed in its dome and project man's sight into the universe two times further than ever before.

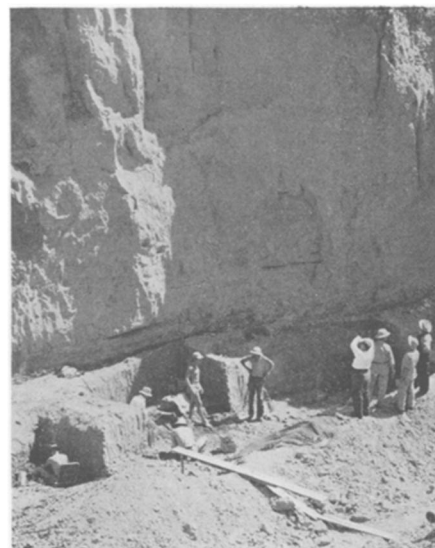
A nova or "new" star was spotted by photography in the constellation of Sagittarius.

A star was found to be rotating rapidly with its axis pointing toward the earth when the lines of its spectrum are not broadened but split into two components due to the effect of the star's strong magnetic field.

A negative correlation was found between size of meteorites and helium content, indicating that accurate estimate of the age of a meteorite cannot be based on helium content alone.

Both red and blue members of Antares, giant red star, were found to be surrounded by an enormous cloud of iron particles existing as extremely minute solid particles instead of in gaseous form.

Production of artificial meteors, created by shooting swarms of iron missiles from V-2 rockets in flight, was attempted to aid study of ionization that affects long-range radio transmission.



**ANCIENT CAMPSITE**—A 20,000 to 35,000-year-old campsite is being attacked with picks and shovels to uncover more traces of the semi-nomadic hunters who were America's oldest known inhabitants. The site is at Lime Creek, Nebraska.

Radar bearings on the sun indicated that the cosmic radio noise originates from long, thread-like prominence filaments that surge into the sun's outer regions.

Total eclipse of the sun on May 20 was recorded by several expedition groups to Brazil, where totality lasted almost four minutes; changes in ionized layer of earth's atmosphere, displacement of stars close to sun, moon's shadow and cosmic rays were studied during totality.

The sun is producing much more energy than is currently believed, study with a sky-observing variation of the snooperscope indicated.

A cloud of gas, dust and cosmic debris, that while in the process of collapsing clashes with another cosmic cloud, might give rise to a solar system with planets, it was suggested; planets thus created would move with circular orbits close to the star's central plane, the largest masses remaining farthest from the sun.

Stages by which stars are built up were reported: individual atoms stick together to form small solid grains, these cosmic grains are molded into clouds by force of radiation pressure, clouds condense to form small dark nebulae that upon compression heat up to become stars.

Cosmic dust is created by condensation, it was reported, every gas atom in interstellar space freezing onto the solid particle which it strikes.

Cloud of cosmic dust between us and stars in the region of the Great Rift in the constellation of Cygnus was stated to decrease the light of the stars a hundred-fold.

Light from white-hot stars was reported to receive a red tint from the tiny particles of interstellar dust through which it passes.

Use of photocells sensitive to red light far beyond the region visible to the human eye

made possible study of atomic lines in infrared solar spectrum, determination of infrared absorption by matter between the stars in the Milky Way and measurement of brightness of stars by day.

New tunable filter showed speed with which gases on the sun move toward us and made it possible to calculate the actual position of these fiery prominences in relation to the sun; a machine was developed to find a star on a photograph and measure its brightness.

New minor planet was discovered following inauguration of world-wide program for study of asteroids.

#### ATOMIC POWER

### Exchange Forces Found In Nucleus of Atom

PROTON, heart of the hydrogen atom, and neutron, trigger of the atomic bomb, were found capable of turning one into the other through exchange of the identifying electrical charge.

Twin or isotope of element 87, francium, was found to turn into astatine, another rare element, after existing only five minutes; neutron bombardment of hafnium produced a new isotope of that element with a half-life period of ten minutes.

Fission, originally confined to heaviest elements, was caused in atomic nuclei as light as tantalum, element 73, by ultra-high energy atomic bullets fired by a giant cyclotron; nuclei of platinum, lead, bismuth and thallium were also split.

Thirty-four different elements were detected among the fission products of atomic-bomb uranium; neodymium, barium, zirconium and molybdenum were found to account for nearly half of the weight of the uranium split asunder.

Elements were transmuted 16 steps down the periodic table and 22, possibly 30, particles were knocked out of an atomic heart

or nucleus with the new 4,000-ton synchrocyclotron.

An apparatus which turns the nucleus of an atom into a miniature radio transmitter sending out a signal that identifies the chemical element was developed on an experimental scale.

Atomic energy pile using plutonium without a moderator, activated by fast neutrons, was devised to release energy slowly.

Bevatron, atom smasher that can speed up electrons to a billion electron volts, was designed.

Photograph was taken of an elusive subatomic particle, the mesotron, that lived only a fraction of a second and then disintegrated; the mesotron is 200 times as massive as the electron and the neutral particle resulting from its disintegration has a mass 50 to 60 times that of the electron.

Three of the four unnamed chemical elements were christened: 43, first artificially-made element, is called technetium (Tc); 85 is given the title of astatine (At); 87 is named francium (Fr); 61, known as promethium, is being investigated to determine whether that obtained from the atomic pile is identical with the naturally-occurring element announced two decades ago.

Long-life radioactive iodine was produced by bombarding the chemical element tellurium.

Improved method of separating carbon of atomic weight 13, useful in medical, biological and industrial research, consists of distilling carbon monoxide over a large-area column into liquid nitrogen as a cooler.

Visible light was found to be given off by moving electrons in a 70,000,000-volt synchrotron, and the electron beam was made visible by its own light.

Three major Atomic-Age research developments were: establishment of biological laboratory at Oak Ridge, Tenn.; founding of three regional institutes for nuclear studies; first sales of radioactive isotopes.

ALSOS report showed that an American scientific mission preceded troops into Germany and found that Germans, although working on an atomic pile, had missed the discovery of how to make an atomic bomb.

Heaviest and most violently radioactive of the chemical elements, curium (no. 96), was isolated in sufficient quantity to be barely visible to the unaided eye; it glows brightly enough to be photographed by its own visible light.

Chlorine, common salt element, was changed by exposure to neutrons in the atomic pile to a radioactive form which will continue to give off radiation for more than a million years.

#### BIOLOGY

### 4-Day-Old Human Embryo Obtained for First Time

HUMAN embryo only about four days old was the first and only authenticated one obtained before attachment to the uterus in the mother's body.

Before birth, superior babies-to-be were successfully transplanted into mother rabbits of just ordinary breeding.

Some hereditary traits were declared to pass from one generation to another by means of plasmagens, carried in the general protoplasm of the cell rather than as genes in or

on the highly specialized little nuclear rods and spheres known as chromosomes.

Changes in the chromosomes of developing male sex cells of plants were produced with radioactive phosphorus taken up in water absorbed by the plants.

Guppy-like fish known as *Mollienesia formosa* were reported to have only one sex—female.

Many cities were made virtually flyless by combined clean-up and DDT-spraying campaign.

Outbreak of hoof-and-mouth disease in central Mexico seriously menaced livestock industry in the United States, especially after authorities abandoned eradication by slaughter and burial.

Tristeza or quick decline, disease of orange and grapefruit trees, was found due to a microscopically invisible, filter-passing virus; in South America and Australia the disease spreads more rapidly from tree to tree than in California.

Weed-killing chemical, 2,4-D, was found to kill plants by robbing them of ability to utilize oxygen in their life processes; onion juice mixed with 2,4-D boosted its weed-killing capacity from 10- to 20-fold; ultraviolet radiation changed its plant-killing power.

HET, newest terror to bugs, killed red spiders and red mites; methoxychlor, close chemical relative of DDT, was reported only one-fortieth as poisonous to man and warm-blooded animals; benzene hexachloride, British insecticide, before killing, deprived single-celled animals of their power to divide; bladin, German-produced insecticide, was tested as a DDT supplement.

Radioactive tracer atoms were used to chart accurately the course of one of the new plant-killing chemicals from the spot where a small quantity is placed on a bean leaf, down the stem and throughout the rest of the plant.

Sugar formed in one leaf of a large sugarcane stalk during one hour's work in the sun was distributed to all parts of the 11-foot, seven-pound stalk within three days, use of carbon atoms tagged with radioactivity showed.

Oxygen absorbed by a plant along with carbon dioxide becomes part of the plant structure, while oxygen that goes in as part of water is excess and comes out again as pure oxygen, it was demonstrated through use of heavy oxygen of atomic weight 18.

By use of radioactive carbon 14 it was discovered that carbon atoms do not linger long in the simple acids and sugars into which they are first built by green plants, but within the first hour are to be found in the more elaborate molecules of cellulose, lignins, carotinoid pigments, amino acids and proteins.

Radioactive "tag" was given to tobacco mosaic, disease-causing virus, by inoculating the virus into tobacco seedlings which were then fed with radioactive phosphorus as part of their mineral nutrient solution.

Early history of copper in the bodies of cattle was studied by the radioactive tracer method, which revealed the heaviest concentration is in the liver.

Fertilizer needs of plants were studied with radioactive phosphorus.

Chlorophyll, green plant pigment that lays the foundation of all foods, was found through use of radioactive carbon of atomic weight 14 to do its work in a two-stage proc-



**IGNORING ATOMIC EXPERIENCE—***These are living sea cucumbers, known as holothurians, on the ocean bottom directly under where the bomb exploded at Bikini. The mud where they are living was highly radioactive and still is somewhat.*

ess, one stage being carried on in the dark.

Chromosomes, heredity-controlling structures, were successfully photographed with an electron microscope.

An enzyme, phosphoprotein phosphatase, was discovered which liberates phosphorus from protein in the eggs of frogs so that the embryo can use the phosphorus in its development.

Cells do all their growing in the immediate neighborhood of their nuclei, then the new-grown living substance migrates to the outside of the cell, study of nerve fibers indicated.

British-originated chemical, isopropyl-N-phenyl carbamate (IPC), proved successful in conquering quackgrass.

DDT stopped the powder-post beetle that damages bamboo and killed the bark beetle that carries elm disease fungus; it protected fruit against damaging insects; warning was issued that DDT be used with care as it can also kill insect friends, and harm small birds, pets and even man.

Rubber trees immune to destructive leaf-spot disease were introduced into cultivation.

Announcement was made of a strain of chickens genetically resistant to range paralysis, destructive virus disease.

Hens lay eggs according to when they get fed rather than according to time of daylight, experiments showed.

Substance that checks growth and one that speeds growth were found in sugarcane.

Minute virus particle was found to kill a bacterium by stealing its phosphorus.

Bacterial strains that resist action of penicillin, streptomycin and other antibiotics were shown to result from rapid evolution or mutation, and not merely a survival of the toughest or selection of resistant cells already there.

Infant orchid plants that grow but never grow up were produced by "doping" them with barbiturate drugs.

Better yields of turpentine and rosin were obtained by inoculating pine trees with spores of a disease fungus when they are tapped.

Heat-treated corn seedlings were found to grow up into plants unable to produce fertile pollen.

Podophyllin, resin extracted from root-stocks of mayapple plant, was found to have the colchicine-like effect of stopping cell division half-way and thereby producing giant varieties of plants.

Too little sleep for too many nights was discovered to retard the growth of white rats and make them highly irritable, but not to impair their ability to learn.

Evolutionary jumps or mutations in mice were produced by a chemical compound, methylcholanthrene.

Eelgrass, chief food of many coastwise wildfowl, was reported to be increasing rapidly after almost being exterminated 15 years ago by a fungus disease.

Living pines of a supposedly extinct species were found to be natural hybrids.

Redwood trees identical with fossil remains of an ancient redwood genus that once grew in the entire northern hemisphere were discovered in central China.

Blood bank for valuable horses, cows and dogs was opened.

Living organisms, viruses and vitamins were sealed in carefully-labelled glass tubes to be opened for research purposes two centuries from now.

Army's soilless gardens produced millions of pounds of vegetables in Japan.

Treatment of seeds with solutions of salts of radioactive elements, and use of such salts along with fertilizer in the soil, was claimed to cause increased yields.

Birds have a state resembling hibernation, observations of many scientifically trained persons indicated.

#### CHEMISTRY AND PHYSICS

### Printed Circuit Radios Made in Calling-Card Size

WORLD'S smallest radio station, complete with tube and circuit that fits in an empty lipstick case, and tiny four-tube radio, calling-card size, proved successful; they utilize the war-developed technique of printed circuits.

Radio tube the size of a rice grain was developed.

Transparent plastic, known as NBS casting resin, was announced as war-developed to shield delicate tubes and circuits without interfering with operation of electronic equipment.

Female sex hormone, effective in small amounts, was concocted artificially from simple, cheap chemicals; it can be given by mouth to relieve women undergoing the difficult transition associated with middle age.

Fibrous protein molecules as complex as those in the human body and other living structures were synthesized, and protein molecules were induced to join one to another in long chains in much the same way that hydrocarbon molecules polymerize to form synthetic rubber.

New scientific terms proposed include the "nuclide," defined as species of atom characterized by the construction of its nucleus, particularly the number of positive electrical units and neutral particles in the nucleus of the atom; and "langley," defined as amount of solar radiation received on one square centimeter, capable of raising the temperature of one gram of water one degree Centigrade.

Neutral meson, sub-atomic particle that lives but one ten-quadrillionth of a second after creation by bombardment from outer space, was declared to play a major role in the creation of cosmic rays.

Cosmic rays were found constantly to create radioactive carbon, present in living organisms and recently dead organic matter.

Sensitive radar was used to detect electrical bursts from energetic cosmic rays.

Diamonds, size-for-size, were found to be a thousand times more sensitive detectors of alpha, beta and gamma rays than the counters ordinarily used.

Synthetic stones, far more brilliant under electric light than in daylight, were made from titanium oxide; star sapphire was made from aluminum oxide.

Gem stones were given the color of more valuable stones through X-ray treatment, but heat or sunlight brought them back to their normal color.

Light was utilized to turn petroleum compounds into synthetic rubber, vapors of such metals as zinc, cadmium and mercury being used as catalysts.

Nylon plastic was synthesized from corn-cobs and oat hulls instead of coal, air and water.

Synthetic compounds with much the same

effects on bacteria and fungi as natural antibiotics were created; most powerful, acrylophenone, has drawback of being only slightly soluble in water and closely related to another compound highly poisonous to animals.

Tyrosine, fundamental body chemical, was synthesized with radioactive carbon; radioactive tyrosine may disclose why potatoes and apples turn black, and help solve some of the mysteries of "black" cancers.

A new chemical, lithium aluminum hydride, was revealed as a reducing agent for highly stable organic compounds.

Noble prize in physics was awarded Sir Edward Appleton of Britain's Department of Scientific and Industrial Research for pioneer work on the ionosphere; Sir Robert Robinson of Oxford University won the chemistry award for research on alkaloids.

#### EARTH SCIENCES

### 70 Major Earthquakes Recorded on Seismograph

THERE were 80 earthquakes of sufficient strength to record themselves on distant seismograph instruments so they could be immediately located, and no less than ten occurred during the eight days after Aug. 26; one on Nov. 1 in Peru caused considerable loss of life and property damage.

Remains of the salamander-like stereospondyls, highest type of vertebrate life known during transition period from Age of Fishes to Age of Reptiles, were found in New Mexico as part of a total find of 35 skulls of animals that roamed the earth 150 million years ago.

Fragments of pelvis, jaw and skull found in Arizona were believed to be those of *Chirotherium* or "hand animal," dinosaur's granddaddy, which dominated the world from about 150 to 200 million years ago.

Nearly-complete fossil skeleton of an extinct Eocene mammal named *Meniscotherium* was discovered in New Mexico; this animal living 60 million years ago may prove to be the ancestor of modern hyraxes or Biblical "conies."

X-rays were used to bring out fine details of bony structure of small fossil fish found embedded in shale.

Underground burning of coal beds long ago was held responsible for certain clinker-like rocks and red beds found in Powder river basin in Wyoming and adjacent areas.

Systematic exploration of world's longest mountain range, the submerged Atlantic ridge that extends almost from pole to pole, was begun.

Mud on the ocean bottom is 9,000 feet thick in places, echo-sounding survey indicated.

Flat-topped mountains that dot the bottom of the western Pacific were described as stumps of volcanoes that became submerged more than half a billion years ago; new chart of Pacific ocean bottom showed a 40,000-foot difference in elevation between bottom of Mindanao trench and tops of highest mountains in the eastern Philippines.

Pacific shoreline once stood along a line running from western Montana to El Paso vicinity, studies showed.

Weather on the ground was reported to come from great whirling eddies cast off from a vast air-river ten miles up, flowing from west to east around the earth with speeds up

to 200 miles an hour.

Man-made earthquake was created by a blast of 4,600 tons of high explosive set off at Helgoland, and vibrations of the blast were recorded on 18 seismographs along a line from the North Sea to the Adriatic.

Volcanoes that erupted include: Mayon volcano in the Philippines, Akutan volcano in the Aleutians, Sicily's Mount Etna, Mount Hekla in Iceland, the Nicaraguan volcano Cerro Negro, and Mount Asama in Japan.

Strangely - colored, never - freezing lakes similar to some in Yellowstone National Park were spotted in Antarctica.

Plans were completed for a World Meteorological Organization to replace the old but unofficial International Meteorological Organization.

Torrential rains in June caused Mississippi and Missouri rivers and all their northern tributaries to go on a ruinous rampage; hurricanes in September devastated parts of Florida and Louisiana.

#### ENGINEERING AND TECHNOLOGY

### Dry Ice Seeding of Cloud Makes Rain and Snow

MAN-MADE snowfall and rain, produced by seeding a supercooled cloud with dry-ice fragments, pointed the way to possible artificial climate changes that might result in less severe thunderstorms, elimination of hail and airplane icing; water seeding was also proposed for making rainfall.

One-step camera produced a finished, dry picture and completely developed negative in one minute; heavy-weight camera for reconnaissance work showed pairs of photographs one minute after they were snapped.

Laboratory camera for taking and developing research pictures was announced; match-box camera and vestpocket darkroom were devised for pictures one-half inch square; machine automatically processed X-ray film in one hour.

Motion picture camera, for use in research and industrial processes, took five million pictures a second, ten times more than high-speed cameras produced before.

Electronic photo-flash unit that fires photographic flashes at three-second intervals was developed; camera with an effective exposure time of four hundred-millionths of a second, used in studies of electrical discharges, was described.

Aerial photographs for large area surveys were taken along straight and parallel lines in the sky through use of a position indicator working in conjunction with Shoran, war-developed navigation aid based on radio.

Automatic pilot successfully varied the altitude of a V-2 rocket in flight, furnishing the first step toward guiding the flight of rockets from the ground by radio control; diffuser of a ram-jet or "flying stovepipe" was successfully tested through use of V-2 rockets.

Flight of long-range rockets was recorded on motion-picture film through the use of an astronomer's telescope placed on the mount of an anti-aircraft gun.

Aluminum metal was obtained from kaolin clay through a process that consists of roasting the clay, digesting it with dilute hydrochloric acid, filtering to remove the insoluble silica, and adding hydrochloric acid gas to produce aluminum chloride crystals.

The common clay bentonite was used to

produce a new plastic by taking advantage of the chemical reaction between bentonite and resin-forming organic polymers.

Nickel and cobalt were successfully plated on metal without the use of an electric current by chemical reduction of nickel or cobalt salt with hypophosphite in hot solution.

Titanium was made possible as a pure metal for industrial use through an improved process that reduced titanium tetrachloride with pure molten magnesium in the presence of helium gas under pressure.

Gas for generating power and manufacturing synthetic products was produced by burning unmined coal in the ground.

Coal-burning gas-turbine locomotives were developed to use finely pulverized coal.

Optical glass for television mirrors was successfully cleaned by bombarding it with electrons under vacuum.

Glass-free porcelains, capable of withstanding heat up to 2,000 degrees Fahrenheit, were made from alumina, beryllia, zirconia and thoria.

Series of tough, serviceable new paints was produced from lactic acid, souring agent in milk.

Electronic stopwatch measured the speed of atomic particles to one thousandth of a millionth of a second and determined the energy of the charged particles in nuclear reactions.

Invisible infra-red rays, used in the same manner as in an Army sniperscope, were reported superior for examining human eyes as they do not disturb the eye under observation.

New chemical resin emulsion, when pumped with water down the well in second-

dary recovery of oil, was found to plug the more permeable layers from which oil has been driven and to direct the water pressure to the other layers.

Dangerous factory and mine gases were detected by an electronic ear that analyzes mixtures of two gases by measuring the speed of sound waves passing through them.

Colored leads were used to record on ordinary paper colored pictures transmitted by wire or radio waves by a facsimile process.

Clearer long-distance telephone reception resulted from use of pulse code modulation technique that, instead of transmitting a continuous speech wave, sends samples at a very rapid rate using a set of code consisting of a definite arrangement of electrical pulses.

Speedy transmission of telegrams from outlying areas resulted from installation of a push-button system at the central office that called for only one typing of the message, at the point of origin.

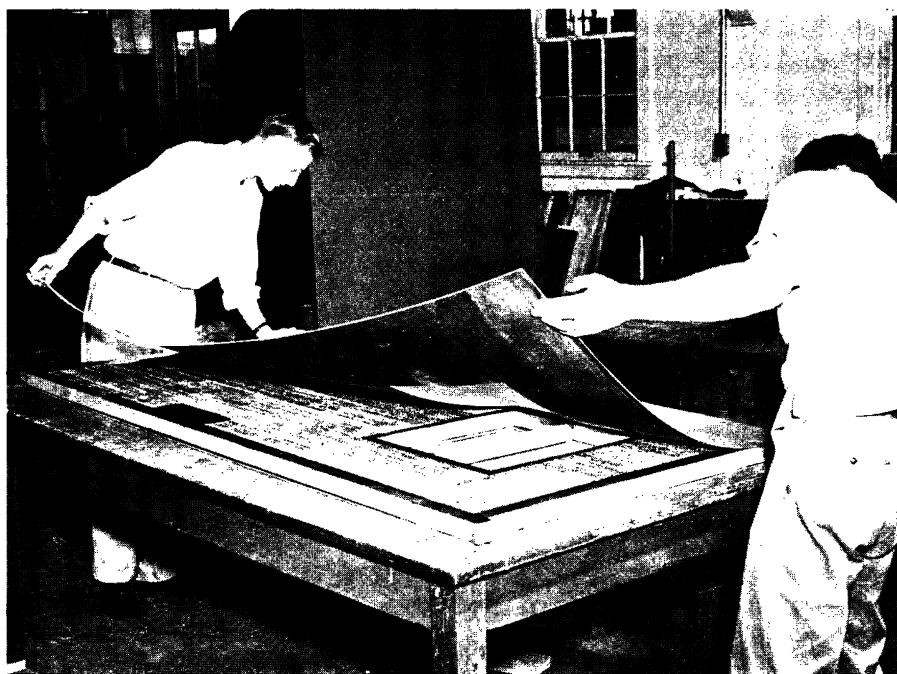
Low pressure system to obtain oxygen from air, developed during the war, was adapted to industrial use, including possibly getting gasoline from natural gas.

Man-made crystals successfully replaced natural quartz used in telephone circuits.

Electroplated wire that can be bent, hammered, woven and twisted without flaking was produced by electroplating quarter-inch rods, then drawing them out into fine wire.

Robot electronic egg candler utilized the differences in quantities of electronic energy absorbed to separate good eggs from bad.

Production of a powerful 3,000-watt mercury vapor lamp greatly widened possi-



**HONEYCOMB SANDWICH**—This type of panel construction has gone into the building of an experimental house by the government. The core, which is the insulating material, is shaped by special machinery to resemble honeycomb. The picture shows a plywood cover being placed over it to be bonded to the core by a highly water-resistant phenolic resin glue. (See page 397.)

bilities of application of light to chemical reactions in the so-called photo-chemical process.

Softening oil made from silica was used in making better rubber tires that resist heat, weather, chemicals and abrasion.

Large savings in sugar resulted from storage of sugar beets at near freezing temperature while awaiting processing.

Radiotelephone equipment was installed on trains, enabling passengers to telephone home or office.

Mightiest bolt of lightning recorded by instruments occurred during the summer; it contained an estimated 345,000 amperes of electricity.

#### INVENTIONS

### Thermal Process Captures Nitrogen from Atmosphere

NOTABLE and interesting inventions patented during the year include:

Fixation of atmospheric nitrogen as nitric oxide by passing the gas mixture through a bed of incandescent oxide "pebbles," further heating in the combustion chamber, then sudden cooling in a twin chamber with unheated pebbles.

Process for purifying water by electricity precipitating the germs on sand or other granular dielectric material.

Addition of methyl-phosphorus compounds to fuel treated with tetra-ethyl lead to check the unsparked ignition due to the lead, without reducing its anti-knock properties.

Use of fluorine for production of synthetic rubber with high resistance to aging effects of sunlight and to action of oil and other rubber solvents, with high elasticity at low temperatures and high tensile strength.

Oxygenless flame of very high temperature obtained from fluorine and hydrogen gases, for cutting or welding metals.

Rifle powder of high energy that consists of tiny grains of a finely pulverized high explosive such as TNT or PETN, each embedded in a pellet of more deliberately-burning smokeless powder.

Study of signal strength upon reception of radio waves of high frequency to obtain data on the relative humidity, temperature and pressure gradients of air masses between two points.

Device that measures the relative amounts of oxygen in mixture of gases by utilizing attraction of oxygen to a magnet.

Thorium extraction from phosphatic minerals containing it by exploiting the phosphoric acid released through addition of sulfuric acid.

Production of rhenium, element discovered two decades ago, from some sulfate ores by collecting the dust, washing, filtering and bringing down the rhenium in the form of an insoluble salt by addition of a soluble compound of potassium.

Production of ammonium sulfamate by mixing an excess of liquid anhydrous ammonia with sulfur trioxide in either liquid or solid form, then letting the excess ammonia evaporate.

More compact electron microscope which uses electrostatic fields instead of magnets for focusing its electron beam.

Beer of better flavor from malt left unbroken until its maximum diastase content

develops, then added quickly to the cooked starch mass.

More rapid dehydration of vegetables through simultaneous use of radiant heat and current of dry, hot air; avoidance or oxidation spoilage by removal of oxygen without which oxidizing enzymes cannot function.

Production of a series of synthetic drugs with marihuana-like action, useful in treatment of narcotic addiction; typical compound made by condensing pulegone with one of the higher benzenes in presence of phosphorus-containing catalyst.

Increased production of penicillin from a given batch of mold through the addition of a few hundredths of one per cent of phenylacetic acid.

Unwettable form of DDT with excellent film-forming properties.

Synthetic rubber with fluorine substituted for the customary chlorine.

Greater production of glycerin through use of an acidified medium that enables ordinary yeast fermentation processes to progress more efficiently.

Increase of oil-well yields through use of bacteria of the genus *Desulfovibrio* that enlarges flow channels by dissolving limestone, makes oil flow more freely by lowering surface tension and increases gas pressure by producing carbon dioxide.

Automatic inspection of objects for standard shape or proper size through use of pairs of phototubes that select objects as approved when a shadow is cast upon only one of the tubes.

New type of viewing screen, composed of a thin layer of image-retaining potassium chloride crystals, for use with electron microscopes, making greater enlargement possible and taking of photographs without having a plate-holder in microscope's vacuum chamber.

Light-signalling system that uses light-waves of differing frequencies at a constant intensity to transmit messages.

Fire-alarm device triggered by ultraviolet rays from the fire's flame rather than by its heat.

Photo-reproduction of text or drawings at mimeograph speed by making use of tendency of tungsten, molybdenum and related metals to turn dark without further treatment when irradiated with light between high violet and near ultraviolet.

Impregnation of paper with methylol urea, a thermoplastic resin, to prevent shrinking, swelling and warping.

Glass with high refractive index, useful for wide-angle camera lenses and microscope objectives, made by substituting germanium oxide for sand in a formula including also titanium oxide and sodium fluoride.

For production of red stained glass, introduction of the copper as vapor of copper chloride in the atmosphere over the still-hot glass.

Typewriter for Chinese characters that eliminates need for separate key and type bar for each character by arranging all the types in rows on a large cylinder rotated into alignment by pressing numbered keys.

Method for keeping a port ice-free by laying long lines of perforated pipes under the channel and pumping air through them.

#### MEDICINE

### Streptomycin Arouses Hope for TB Conquest

HOPE of a chemical conquest of tuberculosis was aroused by good results of streptomycin treatment reported from many clinics.

Initial trial of vaccination with BCG against tuberculosis was begun in the United States as part of a long-range study program.

A chemical effective against tuberculosis in guinea pigs was found in long yellow crystals extracted from a lichen popularly known as California Spanish moss.

Discovery of a prophylactic effect of penicillin against syphilis was announced.

Germs of athlete's foot and various other fungi and parasitic yeasts which cause disease in man and animals were knocked out with tomatin, new addition to the family of antibiotics, made by pressing juice from leaves and stems of the tomato plant.

Germ in a badly infected leg wound yielded a disease-fighting chemical called bacitracin, found effective against boils, carbuncles, styes and ulcers.

Chloromycetin, new penicillin-like remedy, was found effective against experimental rickettsial and virus infections.

Other germ-fighters include: grisein, from the same soil organism as streptomycin and for use with it; aerosporin, from bacterium in some soils and tap water; modified form of gramicidin, for use against surface infections; and compounds found in radish seed, garlic, cinnamon oil and 213 species of mushroom.

Experiments with mice revealed that pneumonic plague was controlled by streptomycin in 90% of the cases.

New chemicals tested as weapons against cancer were: KR, widely heralded Soviet discovery; radioactive gold; ethyl carbamate or urethane; a synthetic substitute for vitamin K; sodium fluoride, iodoacetic acid and malonic acid; and an old Indian remedy, podophyllin.

Sodium fluorescein, dye that glows under ultraviolet light, was used successfully to show a surgeon the extent of cancer tissue to be removed.

Two blood tests for cancer were announced, one with the dyes, brilliant cresyl blue and methylene blue, and the other by inspection of serum under ultraviolet light.

Spread of cancer cells, called metastasis, was attributed to lack of adhesiveness of the cell surface.

Chemical in mother's milk that causes breast cancer in mice was isolated.

Evidence of a relation between breast cancer and over-femininity, in the sense of unopposed action of female hormones, was found.

Jackson Memorial Laboratory at Bar Harbor, Me., famous genetic and cancer research center, was destroyed by forest fire.

Clue to why cancer kills was found in its action of robbing the body of its stores of nitrogen and holding it trapped so the rest of the body cannot use it.

Discovery that marine bacteria can decompose cancer-causing petroleum hydrocarbons brought the suggestion of their possible role for preventing or curing cancer.

A red blood cell extract was developed and showed promise for use both as preventive and remedy for erythroblastosis, often

fatal disease of new babies born to mothers with Rh negative blood.

Tyrosinase, which turns potatoes black, and another chemical in urethane, were reported to have some benefit in treatment of leukemia.

New synthetic pain-relieving drug known variously as amidone, dolophine and 10820, was reported two to four times as effective as morphine, but also capable of causing addiction.

A morphine derivative, metopon, found less addicting than morphine, was made available for pain relief in cancer patients only and under restrictions to prevent its misuse.

Ten-year survey of male sex habits was reported.

A new operation and a special instrument were devised for freeing one of the heart's valves of binding scar tissues.

Blood-shunting operation in which the great cardiac vein was made to do the work of the heart's artery was developed for relief of coronary thrombosis and sclerosis.

Isolation of two more blood fractions, an iron-copper carrying chemical and another which separates as a mercury salt, was announced.

Two anti-influenza chemicals LL47 and apple pectin, effective in laboratory experiments, were reported.

New inroads against tooth decay include: rhubarb mixed with lemon juice to protect teeth against the acid's erosive action; plan for mass control of caries at the source by adding glycerol aldehyde (simple, tasteless chemical) to all sugar at the refineries to check fermentation and acid formation from sugar as eaten; tryptophane, an amino acid, as a possible decay preventive; treatment of children's teeth twice a year with sodium fluoride.

Remedy for intestinal paralysis was found in a poisonous war gas, di-isopropylfluorophosphate (DFP).

Vitamin C and the amino acid, histidine, given together to cause release of histamine in the body were announced as effective treatment for serious conditions, including gangrene, in which blood circulation is impaired.

Improved treatment for infantile paralysis followed discovery that bulbar poliomyelitis takes five different forms, each requiring specific treatment.

First direct observation of protein synthesis outside the animal body, of importance in cancer study, was achieved with radioactive sulfur.

Body chemical called histamine was found to transform certain cells of the body from their resting state into active germ-eaters.

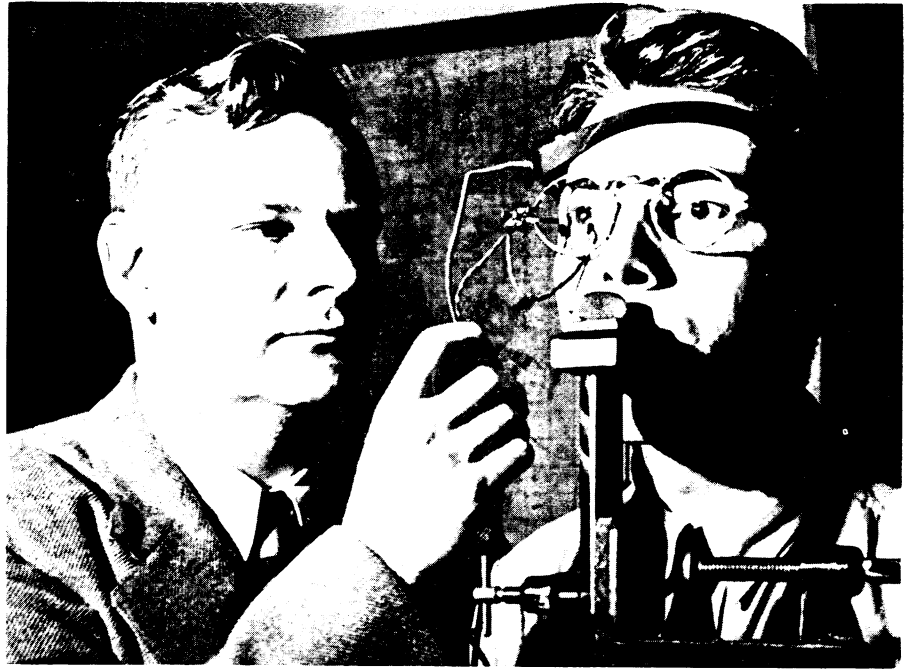
Antimalarial 100 times as powerful as quinine was extracted from the leaves and roots of a Chinese plant, *Dichroa febrifuga*.

PAB, used in ridding livestock of parasitic worms, had a sulfa-like action against the exceedingly minute germs called Brucella; chemical from mold found in soil of cattle inclosure showed promise as remedy for undulant fever.

Malaria germs were grown outside a human or animal body, offering a new technique for testing antimalarial drugs.

A dual photoelectric device clipped to the ear aided infantile paralysis patients by giving doctors an actual and continuous measurement of the oxygen in the blood.

Cyanine dyes and chemicals called piperazines were announced as promising for treat-



**ELECTRIC RESPONSE**—Dr. Lorrin A. Riggs, psychologist at Brown University, measures the electric current on the eye of his co-worker, E. Parker Johnson, by means of an electrode inserted in a contact lens. In this way it is possible to measure the eye's visual sensitivity. (See SNL, Nov. 29.)

ment of the tropical disease, filariasis.

One type of hardening of the arteries, atherosclerosis, was reported linked with the physical state of fat in the blood.

The anti-war gas chemical, BAL, was found effective in overcoming gold poisoning in arthritis patients getting gold salts treatment and also lead poisoning.

One of the nitrogen mustard war gases brought improvement in the incurable chronic disease, Boeck's sarcoid, but cannot yet be classed as a cure for the condition.

Quick antidote to the occasional hemorrhagic effect of heparin, anti-blood clot chemical, was discovered in protamine, a fish-protein chemical.

Blood chemical, hemin, was found to prolong insulin's action.

New fat hormone produced by the adrenal glands was discovered responsible for moving fat from liver reserves during starvation.

Peacetime national blood program for collection and distribution without charge of blood, plasma and blood fractions used to treat and prevent disease was announced by the American Red Cross.

An official long range research program on the after-effects of the atom bomb among Japanese was started.

A dye, toluidine blue, was found effective in laboratory tests in controlling the bleeding of radiation sickness.

New atomic danger, plutonium poisoning or "plutonism," was found to cause greying hair, liver damage and bone cancer in laboratory animals; treatment with a harmless metal, zirconium, to displace the poisonous element was reported effective.

Radioactive sex hormone was made for the first time by using carbon 14 from the atomic pile to prepare synthetic male hormone.

Radioactive germs and radioactive penicillin were prepared so that scientists could trace both the germs and the drug through the body and determine, if possible, how the body's immune mechanisms work.

A new drug, dibenamine, and pentobarbital may avert death from shock following severe bleeding, it was reported.

Patients with liver disease and abdominal dropsy were reported to have increased amounts of an anti-diuretic substance in the blood.

A fat mobilizing substance or hormone was discovered in the urinary excretion of fasting animals.

Para-aminosalicylic acid, PAS for short, proved effective in checking tuberculosis in guinea pigs, and clinical trials were started.

Microwaves, such as used in radar, were introduced as medical agents better than diathermy for heating internal tissues.

The Nobel prize in medicine and physiology was awarded to Dr. Carl F. Cori and his wife, Dr. Gerty T. Cori, Washington University School of Medicine, St. Louis, for their discovery of what happens to sugar and starch in the body, and to Dr. Bernardo A. Houssay, of Buenos Aires, for his discovery of the relation between the pancreas and the pituitary gland.

#### PSYCHOLOGY AND PSYCHIATRY

### Hypnotizing Drug Used for Relief of Morbid Fear

PENTOTHAL, hypnotizing drug that helped soldiers recover from combat-induced mental sickness, was used for rapid relief of a civilian from his morbid fear of closed spaces.

New, safer form of electric shock treatment in which each pulse lasts only one-half to one-thousandth of a second was successful against depression; shock by weak electrical current followed by a deep, dream-like sleep was found useful.

Two personality tests, Rorschach ink-blot test and Minnesota Multiphasic Personality Inventory, were used to separate quickly curable mental patients from resistant ones.

Lack of sleep for five days and nights made a healthy young man temporarily "see things," laugh and talk crazily, and show other symptoms of the serious mental disease, schizophrenia, pointing to a relation between the two conditions.

Mental patients were found to have an average intelligence quotient eight points below the normal expectancy of 100; alcoholics and neurotics rated highest intellectually, epileptics and syphilitics among the lowest.

Inability to form new conditioned reflexes was used as a clue to serious brain damage, and to distinguish between functional disturbances and organic disturbances.

Children displayed more intelligence after treatment with glutamic acid.

Chemical constitution you inherited from your parents plus the environment in which you live was reported to determine whether you would become an alcoholic; alcoholic addicts were declared subconsciously to enjoy being treated badly.

Smell is not a chemical sense but is due to infrared radiation from the sense organ, according to a theory confirmed by experiments; odorous substances are those capable of absorbing radiation of the critical wavelengths—eight to 14 microns.

Tapping of electric currents from the eye itself was found to be an objective method for measuring visual sensitivity uncomplicated by what happens in the brain's visual centers.

Possibility that sounds may be used to produce an illusion of sight for the purpose of guiding a pilot into an airport was the outcome of war research.

Simpler instrument panels with fewer, less confusing dials and knobs easier to reach and manipulate also resulted from these programs.

#### GENERAL SCIENCE

## Ten Top Science Advances

► THE TEN most important advances in science made during 1947, as picked by Watson Davis, director of Science Service, are:

1. Discovery that smell is detected by infrared radiation absorbed by odor material reaching the nose.
2. Pilotless plane that crossed Atlantic untouched by human hand at controls.
3. Attempts at artificial rainmaking through sprinkling dry ice or water on clouds under certain conditions.
4. Synthesis of protein in long-chain molecules, promising new plastics of medical and industrial importance.

An auditory afterimage was found to follow a buzzing sound of high intensity, causing familiar sounds to have a strange metallic quality.

A person's ear was reported to be more sensitive to interruptions in sound than his eye to a flicker in light, being capable of noticing the difference between a continuous noise and one interrupted 1,000 times per second; this research is important in new telephone systems.

Sight, except for responses to light, must be learned, it was shown through studies with baby chimpanzees raised in darkness and humans born blind in whom sight was restored.

Master hearing aid that will suit almost all deafened persons was made possible by war research on noise and communications.

Learning under intense pressure tends to be narrow and rigid so that a need to adapt under changed conditions results in frustration; this finding from animal experiments is believed to explain the psychological difficulties of men and nations.

Most accurate prediction of a man's leadership comes from the men who work with him, it was found, as intelligence, mechanical aptitude and personality tests fail to predict ability to command in combat.

Lefthandedness can be predicted while the person is still a baby from study of his posture in motion pictures made at monthly intervals, it was reported.

Punishment may stamp in the behavior for which punishment is given, it was indicated by studies in which rats punished for running often ran faster.

People begin to lose their strength at the age of 25, measurements of hand strength showed.

Although school books intended to build a child's vocabulary only introduce about 500 new words a year, the average child was found to add 5,000 new words to his vocabulary every year.

Two-thirds of the mothers bringing their babies regularly to a health clinic, and themselves learning a realistic and tolerant attitude toward infant behavior, reported their babies had no unapproved habits.

*Science News Letter, December 20, 1947*

5. Interconversion of proton and neutron fundamental particles and smashing of many more elements yielding new isotopes and transmutations in world's highest voltage synchro-cyclotron.

6. Largest display of sunspots in over a century.

7. Use of streptomycin in tuberculosis treatment.

8. Development of jet bombers and higher speed jet planes.

9. Discovery of 10,000 year-old Tepexan man in Mexico.

10. Camera that makes finished photoprint in one-step process.

*Science News Letter, December 20, 1947*

## Do You Know?

*Alfalfa* may some day be grown as a source of food for humans; it is rich in proteins.

The *frost* that forms on the freezing compartment of an electric refrigerator can be melted and used where relatively pure water is required.

Four methods of *air disinfection* for hospitals are recommended: ultra violet radiation, chemical disinfection with sprays, dust suppression, and ventilation.

Starting from sea-level, the *temperature* of the atmosphere drops steadily up to an altitude of about 12 miles, then remains constant for several miles, rising at an altitude of 36 miles and later dropping again.

Butyl alcohol, a possible *fuel* for automobile engines, is obtained from corn-cobs by a new process in which the cobs are treated with an acid, yielding glucose, or corn sugar, and xylose, once called wood sugar.

#### ENTOMOLOGY

### New Unwetable DDT Will Provide Poisonous Film

► MOSQUITO "wigglers" coming to the surface to breathe, also their mothers coming down to lay another clutch of eggs, are in for worse DDT trouble than ever. For covering the water surface there is very likely to be a persistent, poisonous film of a new "hydrophobic" DDT.

This does not mean that the mosquitoes will get hydrophobia; it merely means that the etymology of this new entomological woe indicates that the compound "hates water", in the sense that it cannot be wetted and thus washed out or sunk.

This new, unwetable form of DDT, on which U. S. patent 2,430,288 has been issued to a du Pont chemist, Albert L. Flenner of Wilmington, Del., is prepared by hooking the DDT molecules up to molecules of stearylamine, which are long-tailed affairs built somewhat like soap molecules, then mixing to a paste with tricalcium phosphate. Dried and re-powdered, this forms highly fluid dust, the particles of which stick to each other but will not stick to water. Hence their excellent film-forming properties.

*Science News Letter, December 20, 1947*