

GENERAL SCIENCE

# War and Medicine Led 1941 Science

**Bread Enriched for Health; Vitamin Cures Gray Hair; Radio Locates Attacking Planes; Sulfa Spray for Burns**

*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, December 27.)*

By SCIENCE SERVICE STAFF

**M**AN'S WAR against disease resulted in significant progress during 1941. Man's war against man blanketed with secrecy undoubted progress in physics, chemistry and other fields.

Even before the coming of fighting war to America, Science pledged its full effort to victory.

Bread was enriched with vitamins to enhance American morale and health. Vitamin therapy gave hope of restoring and preventing gray hair. The sulfa drugs continued their conquest of diseases and proved effective in treating burns. New methods of spread of encephalitis and infantile paralysis were discovered.

A flying wing and new giant planes were flown. A radio locator of attacking planes was one of the few war inventions made public. Sun disturbances sprayed aurorae over earthly skies and interfered with radio.

In addition to these highlights of 1941 science, Science Service's annual survey shows these outstanding accomplishments and events:

AERONAUTICS

## America Builds World's Biggest Fighting Planes

The Northrup "Flying Wing," housing motor and personnel within the airfoil and with radically new control means, was successfully tested.

The World's largest flying boat, capable of flying non-stop across the Atlantic and back, with a 200-foot wing-spread and powered by four 2,000 horsepower engines, 70-ton Martin's XPB2M-1, was launched.

The world's largest bomber, the 212-foot wing-spread, 82-ton Douglas B-19, took to the air.

A 2,000 horsepower single-seater interceptor plane, powered by one 14-cylinder motor, was produced by Republic for the Army, its mission being to climb fast to sub-stratosphere altitudes and attack bombers with its exceptionally strong fire power.

A new four-engined bomber, Boeing B-17 E, equipped with superchargers for high altitudes, self-sealing tanks, armor, retractable power turrets and increased fire power, was announced by the Army Air Corps.

A twin-engined monoplane constructed of resin-bonded plywood was successfully flown.

A helicopter was successfully kept in the air for a short time in the United States.

Airplane factories were reorganized to operate on a mass-production basis and airplanes were manufactured for the first time by assembly of sections and parts made in scattered plants of automobile and other manufacturing companies.

An airplane instrument consisting of a neon tube and micrometer connected to a pointed tungsten rod picks up electrical discharge from a cloud and warns the pilot to change his course when he is approaching too close to lightning.

The exhaust-gas turbosupercharger which packs the thin air of high altitudes into engine cylinders until their oxygen is the equivalent of sea-level density was produced in mass for lend-lease planes.

A method of preventing air locks in fuel lines and accumulation of gasoline vapors in fuel tanks was developed as a modified centrifugal pump attached directly to the fuel tank.

Methods for contact, projection, and electrolytic printing directly onto metal patterns or templates speeded airplane production.

A new technique for spot-welding aluminum alloys speeded aircraft production.

Explosive rivets, set off by a heat unit gun, were used in the thousands of fastening points on airplanes which are accessible from only one side, to speed production.

Equipment was furnished for meteorological observations of the upper air to be made from

steamships over a route from New York to Lisbon for the benefit of transatlantic flying.

Bullet-sealing fuel hose was used with self-sealing fuel tanks to prevent leakage and fire in the air.

The Army Air Corps experimented with various types of artificial surfaces to be laid as runways on temporary landing fields where mud or rough terrain make such surface necessary.

An airplane engine research laboratory was donated to the University of Kentucky by a Swedish industrialist.

A new speed record for a west-east crossing of the Atlantic was set in delivering an American plane to Great Britain.

ANTHROPOLOGY—ARCHAEOLOGY

## High Altitudes Produce New Variety of Human

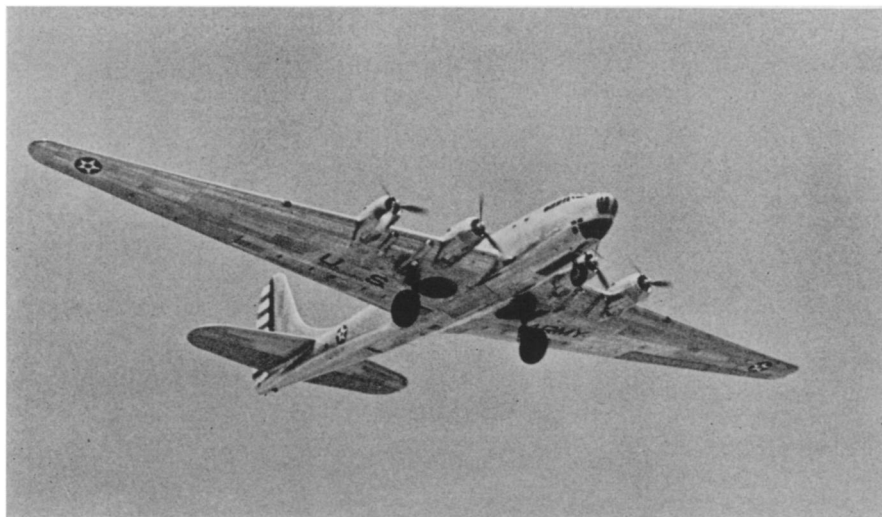
Life two or three miles above sea level has transformed Andean people into a distinct physiological variety of the human species, was the report from Peru.

The Government's first scientifically designed functional fashions for women in defense industry and farm work were launched.

Found in Siberia, a unique statuette representing an Old Stone Age woman in costume was pronounced by an American archaeologist to be striking evidence of style survival, since northeast Siberian natives wear the 15,000-year-old type of garment.

A blood test given to Wah, 4,000-year-old Egyptian mummy, showed his blood to be type B, like that of many modern Egyptians.

Australia's first people were probably pigmies who occupied the entire continent was the new theory advanced by a scientist who told of measuring and observing inherited traits in 2,500 natives and half-castes in 100 living Australian tribes.



### WORLD'S LARGEST

*This great 82-ton bomber with 212-foot wing spread took to the air during 1941. It is the Douglas B-19. This is an official Army Air Corps photograph.*

Word came from unoccupied France that a magnificent 30,000-year-old gallery of prehistoric cave art was discovered near Montignac, southwest France.

Soviet archaeologists opened tombs in the great mausoleum of Tamerlane and his descendants at Samarkand, and examined the kneecap damage causing Tamerlane's lameness.

The first full account was published of the flying explorations which Americans undertook in 1935 to 1937, surveying Iran archaeologically from the air.

That Iraq's earliest people, the Sumerians, ate pork, mutton, beef, and some game and fish was determined by a study of animal bones from ruins of Tell Osmar near the Tigris.

Jesus Christ was not 33 but a middle-aged man nearly 50 years old when He died, an American scholar concluded from new studies of the Babylonian calendar.

A remarkably large tower of the famed Third Wall fortifications built by King Herod Agrippa came to light during excavations in northern Jerusalem.

New light on evolution of architecture of Jewish synagogues was gained from a report on ruins at Dura, Syria, where early synagogues had living quarters attached.

Older than America's Folsom Man type, Sandia Man emerged as a type that lived in caves, hunted now extinct animals, built fires, cooked his food and wore clothes, probably more than 25,000 years ago, according to geologists, and revealed through 5 seasons of excavation in Sandia Cave, New Mexico.

Rough stone knives and other tools used in the beach life of Canadians apparently more than 10,000 years ago were discovered near Lake Huron in Ontario.

A very large collection of 500 skeletons was unearthed at Point Hope, Alaska, where previous digging had unearthed a well-planned town of the prehistoric Arctic, abandoned about 2,000 years ago.

First detected by a schoolboy, cliff shelters at Bear Mountain, N. Y., yielded quantities of pottery and artifacts left by the Algonquian Indians who preceded the Iroquois in the Hudson Valley.

Some of the Mississippi Valley's progressive Indians of the Hopewell Mound Builder culture migrated as far east as Pennsylvania was the deduction from finding there a well-preserved skeleton of Hopewell type with Hopewell objects.

A presidential proclamation authorizing addition of five acres to the Ocmulgee National Monument near Macon, Georgia, made it possible for CCC boys to excavate an Indian stockade and provide data for reconstructing an old Creek Indian town.

Resembling previous discoveries in Texas caves, skeletons and artifacts of a primitive type of cave-dwelling Indian were found in northern Mexico, indicating that several thousand years ago this culture was spread over a considerable area.

Homes of plain citizens of the Mayan Indian world were examined in the ruined "City of the stone lady" in British Honduras, showing a wide social gap between lower and upper classes.

As a good neighbor project, the United States launched ten archaeology expeditions in Latin American countries, joining hands with scientists of these lands to fill in missing data regarding America's prehistoric past.

Explorers found two lost Incan cities 12,000 feet high in the Peruvian Andes, and evidence that Indians occupied a network of high altitude cities in what is now rank wilderness.

The opportunity to unearth stratified burials in Peru's northern coast aided archaeologists in

fitting little-known peoples of pre-Incan times into Peru's prehistory.

For the first time, an anthropologist measured bare bones of some of Peru's gorgeously wrapped mummies from Paracas, as a step toward understanding their relationship to other ancient Indians of Peru.

#### ASTRONOMY

### Brilliant Aurora Display Seen in United States

One of the most brilliant displays of aurora observed in the United States occurred Sept. 18 in connection with large sunspot groups, accompanied by magnetic storms and interrupted radio and wire communications.

Due to the war the total solar eclipse of Sept. 21 went unobserved by American astronomers, with only curtailed Russian, Chinese and Japanese expeditions in the field.

The presence of the chemical element thulium in the sun's atmosphere was demonstrated.

The temperature in the sun's core was computed to be 25,700,000 degrees Centigrade.

"Coronium" causing mysterious solar spectral lines, was ascribed to "broken atoms" or ionized iron, calcium, and nickel, especially Fe XIV with loss of 13 electrons.

Temperatures in excess of 1,000,000 degrees Centigrade just above the sun's surface, instead of 10,000 degrees previously measured, were proposed to accord with the new ideas about the origin of the sun's "coronium" lines.

A more accurate solar parallax was determined from observations of the 1931 opposition of Eros, corresponding to a mean sun-earth distance of 93,003,000 miles, with the small probable error of only 8,000 miles.

Actual motion of solar prominences was made possible of determination by a new instrument that gives radial velocity.

A brilliant eruption of hydrogen gas from sunspots was associated with severe radio disturbances on July 4.

The sun sweeps up about 110,000,000 tons of hydrogen from space each second and uses it as fuel, according to a new theory.

Stars were calculated to change shape while revolving in elongated orbits around their companions, stretching to egg-shape and at other times being more round.

The star Sheliak (beta Lyrae) was described as involving a gigantic pinwheel of red, yellow and green gases, spiralling outwards for 50,000,000 miles from a double star.

Star 26 in Draco was found to be a triple system like alpha Centauri.

The Andromeda galaxy was shown to be about as big as our own galaxy or Milky Way.

Spectra of supernovae were interpreted without the assumption of an excessively high temperature, indicating they are similar fundamentally to ordinary novae.

A force 200 times gravity, caused by light pressure and acting on dust particles between the stars, was discovered.

Planets may be born of a triple star constantly picking up matter from cosmic clouds in space, according to a new theory that would make planetary systems less rare than previously thought.

Because meteors passing through the atmosphere many miles above the ground leave behind for many minutes a mirror for radio waves, consisting of broken atoms, experiments show the possibility of counting meteors in daylight or cloudy weather by radio echoes.

Some of the glow of the night sky was shown



#### FOURTEENTH CENTURY MADONNA

The museum science of dating an art work by clues and expert knowledge is nicely illustrated by this medieval Madonna sculpture just presented to the Cleveland Museum of Art, and featured at its Christmas-tide exhibition. The verdict is that the image was carved at the beginning of the fourteenth century. Reasons given by Director William Milliken include: Twelfth century sculptors usually portrayed the Virgin seated exactly facing front, with the highly stylized Christ Child on her knee. In the thirteenth century she was usually shown standing, still facing due front. Gradually, the body was shown with a side-sway, which in the fourteenth century almost disfigured some statues. The grave twelfth century Christ Child in the fourteenth century became playful, worldly, overly realistic. The statue "stands at that happy moment in the beginning of the fourteenth century when some of the noble traditions of the thirteenth century still held," says Mr. Milliken. "There is new elegance which pointed forward but none of the emphasis on worldliness and affection."

to be due to the magnetic activity of the earth and its atmosphere.

Atmospheric pressure causes meteors to fly apart as they plunge to earth, studies of their trails showed.

A vanishing kind of matter, contraterrene, which explodes devastatingly in contact with ordinary matter, was postulated to account for meteor craters in which meteorites are not found.

New comets discovered included: Friend-Reese, Paraskevopoulos, Van Gent, du Toit-Neujmin.

Cunningham's comet, dis- (Turn to page 395)

## ENGINEERING

## Frequency Modulation Applied to Telegraph

**T**ELEGRAPH lines now use the trick of the new FM radio, putting more messages over one circuit with less interference.

Western Union has announced the first use of frequency modulation or FM on its wire network to combat the troubles caused by sharp weather changes that sometimes throw sensitive carrier currents out of balance.

FM radio (contrasted with the conventional AM or amplitude modulation of most broadcasting stations) invented by Maj. Edwin H. Armstrong is coming into use extensively in radio broadcasting stations of a new breed. FM gives radio signals that cannot be mused up by static. Static is not a trouble in wire telegraphic circuits but there are other difficulties that FM does take care of.

*Science News Letter, December 20, 1941*

## AERONAUTICS

## Japs Copy Nazi And U. S. A. Planes

**J**APANESE secrecy has effectually prevented American Army and Navy officers from obtaining dependable knowledge about the latest types of Japanese airplanes, as well as about the numbers of them possessed by the island empire.

"To get any real information about them we'll have to wait until we shoot down a few of them," an Army Air Force officer confessed.

Articles in the standard reference works on military and naval planes and in recent numbers of aviation journals, disclose exceedingly little. The known types of planes built in Japan show no originality in design whatever. In this they differ sharply from ship design in the Japanese Navy, some of which are original to the point of freakishness. Known Japanese planes are mostly copies of foreign models, mainly German, Italian and American, and none of them are particularly new. The same is true of the engines with which they are powered.

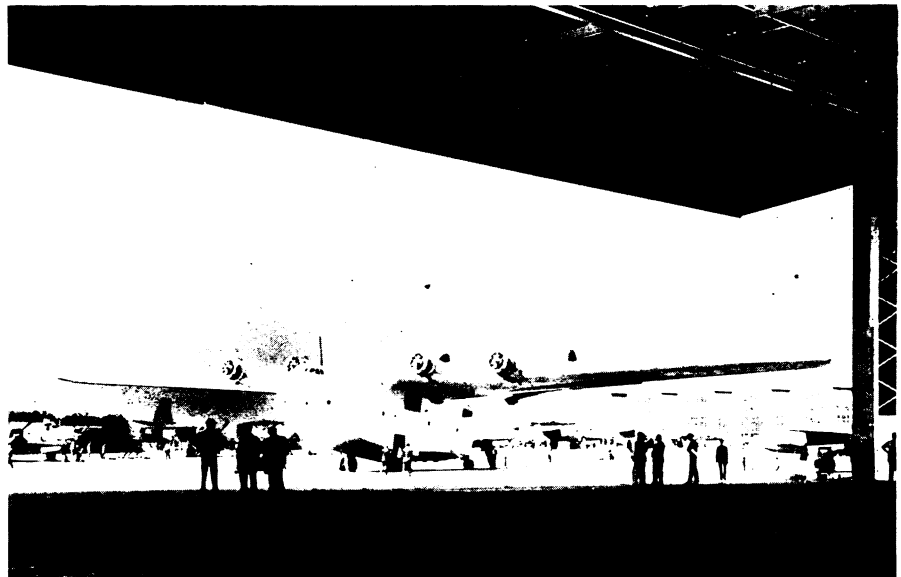
*Science News Letter, December 20, 1941*

## From Page 388

covered in 1940 reached naked eye brilliance at the beginning of 1941.

Periodic comets resighted were: Encke, first Schwassmann-Wachmann, second Schwassmann-Wachmann (1929I).

The first Schwassmann-Wachmann comet experienced a remarkable temporary increase in brightness.



### LARGEST FLYING BOAT

*The Mars, giant four-engined flying boat, is designed to be able to fly across the Atlantic and back without stop. She was launched on November 8 with full naval ceremonies. This is an official U. S. Navy photograph.*

## BIOLOGICAL SCIENCES

## Radioactive Carbon Atoms Trace Nutrition Cycle

Radioactive "tagged" carbon atoms made it possible to follow food substances through a plant's whole nutrition cycle.

Plant tumor tissue, free of the bacteria that originally accompanied its growth, was grafted into healthy plants and grew there.

Seeds buried in bottles 60 years ago were resurrected and found still viable.

Seedless watermelons were produced by treating unpollinated flowers with growth hormones.

The international treaty for the protection of the Pribilof island fur seal herd expired, and because of the action of Japan was not renewed.

There was a very large increase in waterfowl population.

The U. S. bird population was estimated as at least five billion.

A natural growth-promoting substance, more powerful than synthetic chemicals, was found in ripening pollen.

Colchicine injected into incubating eggs produced chickens with double-sized combs.

Sulfanilamide was found to have somewhat the same effects as colchicine, in speeding evolutionary changes in plants.

Hormone modification of sex after birth was accomplished in experiments on opossums.

Week-old mouse embryos grew successfully when grafted on three-day-old chick embryos.

Success in transplantation of eyes of tailed amphibians with return of vision was announced.

Vitamin B<sub>1</sub> was found concentrated in tree buds.

Wax from a green-linted cotton variety was investigated as a possible ingredient for polishes.

A new species of white blackberry was discovered in Florida.

It was demonstrated that tobacco plants produce nicotine in their roots.

Pressures on the order of 5,000 pounds per square inch were found to have a paralyzing effect on protoplasmic movement.

Fly larvae that, like spiders, catch other insects in webs, were discovered in the Southern Appalachians.

The parasitic dodder vine was proved capable of carrying disease viruses from plant to plant.

A new disease of cotton was reported from China.

A one-dose vaccine for hog cholera was announced.

Arsenic was found to be a good antidote for selenium poisoning in animals.

Effective contact sprays were discovered for combating Japanese beetle, and distribution of the "milky disease" bacteria that kill their larvae was undertaken on a large scale.

Chloropicrin, tear-gas of World War I fame, was found a good preventive of eelworm damage to several crops.

Prof. D. R. Hoagland and Dr. D. I. Arnon, University of California, were awarded the \$1,000 prize of the American Association for the Advancement of Science for revolutionary discoveries regarding plant nutrition.

## CHEMISTRY AND PHYSICS

## Organic Molecules May Have Been Photographed

American commercially built electron microscopes, magnifying 10,000 to 125,000 diameters, were used to probe minute structural secrets of rubber, plastics, industrial dust, smoke, rouge, face powder, radio tube filaments, and even biological tissues, cells, bacteria, viruses; it is believed organic molecules have actually been photographed.

The surface of steel and other materials opaque to electron rays were nevertheless studied with the electron microscope by the device of making a thin plastic replica of the surface.

Extraction of magnesium from sea water was begun commercially.

Synthetic rubbers finally got into quantity production, and one type, combining the cold-resistant powers of natural rubber with the oil-proofness of the synthetic, was found useful for automobile and airplane tires.

A new process of making chlorine without the use of electricity was discovered, thus saving large quantities of electrical energy for the manufacture of aluminum and other vital defense purposes.

A new process was developed for the working of low-grade manganese ores, to render this country independent of overseas sources.

Cotton plants were found to be as good a source of cellulose, much used in plastics, as wood.

A synthetic method of making glycerine from petroleum refinery gases was discovered.

Starch was synthetically produced from glucose for the first time without aid of living organisms.

X-rays disclosed that the hardness of a plastic depends upon the degree of orderliness in the arrangement of its molecules and this can be regulated by the heat treatment.

The theory that cosmic rays are born of the suicide of atoms in outer space received confirmation in new evidence that the rays before entering the earth's atmosphere have energies corresponding to the annihilation energies of the most common atoms. Evidence that cosmic rays in outer space are protons (the heavy parts of atoms) was also found.

A new measurement of the speed of light gave its velocity as 186,272 miles per second, 12 miles per second less than the previously accepted value.

The speed of radio waves was proved by direct measurements to be practically the same as that of light, as had been generally assumed.

Construction of the 100,000,000-volt cyclotron at Berkeley, Calif., was well advanced during the year.

Etching glass with hydrofluoric acid vapor was found to eliminate troublesome reflections by forming a film of calcium fluoride one-quarter of a wave-length of light in thickness.

An electrostatic generator giving 4,500,000 volts was constructed.

Television pictures were projected on a theater screen 15 by 20 feet in size from a balcony 60 feet away.

Aligned molecules instead of minute crystals produced a nearly 100% efficient polarizing screen, the first to be made entirely of synthetic materials.

A method of detecting airplanes at night by means of the heat waves they emit was invented.

Transmutation of mercury into radioactive gold with a half decay period of 48 minutes was accomplished by bombardment of the mercury with fast neutrons.

Green diamonds were produced by bombarding white ones with atomic particles from the cyclotron and were found to be identical with the naturally occurring and highly prized green diamonds.

Carbon bullets with energies of 96,000,000 electron volts, as powerful as some of the cosmic rays and six times as powerful as the most energetic atomic projectiles previously produced (those of deuterons or heavy hydrogen), were manufactured by the cyclotron.

Radioactive strontium and barium, free from

impurities, were produced for the first time.

Four radioactive forms of germanium, an element similar to lead, were produced by the cyclotron.

The theoretical possibility of elements heavier than uranium, the existence of which had been doubted despite claims of experimental discovery, was demonstrated.

Vacuums, reaching a millionth of an atmosphere pressure, higher than ever before employed in chemical technology, were used to extract vitamins from fish oil.

A temperature of 45,000 degrees Fahrenheit, as hot as found on the surfaces of the hottest stars, and a light 50 times as bright as the sun while it lasted, were given by a spark produced by discharging 40,000 kilowatts of electrical energy through a quartz tube.

An infra-red photoflash bulb was invented by which instantaneous photographs can be taken in complete darkness.

Evidence was obtained that the mesotron (middle-weight atomic particle) can exist in at least two states which decompose at quite different rates.

The Henry Draper Gold Medal of the National Academy of Sciences was presented to Dr. R. W. Wood, professor emeritus of experimental physics at the Johns Hopkins University, for his pioneer researches.

Dr. Thomas Midgley, Jr., Worthington, Ohio, was awarded the Priestley Medal of the American Chemical Society, for discovery of the anti-knock properties of tetra-ethyl lead and other achievements.

Sir Chandrasekhara Venkata Raman, director, Indian Institute of Science, discoverer of the "Raman effect," was awarded the Franklin Medal of the Franklin Institute for his contributions to physics and leadership in India's science.

#### EARTH SCIENCES

### New Weather Map Provides Much More Information

A new type of weather map, giving much more information than the old, was inaugurated by the U. S. Weather Bureau.

There was a severe late summer and autumn drought in the East and Southeast; too much rain in parts of the West and Southwest.

This country's known oil reserves reached an all-time high, at 19,025,000,000 barrels.

Several hurricanes lashed Caribbean and Gulf regions, which had been almost hurricane-free for two years.

A devastating storm ravaged Portugal and Spain in mid-February.

Forecasters were able to make predictions for 5 to 7 days approximately as reliably as the 2- or 3-day forecasts previously had been, and the reliability of 2- and 3-day forecasts improved materially.

A new mineral, with the smallest known natural crystals, was discovered in Argentina, and named sarmientite.

Apparatus was built for taking flashlight photographs of the ocean bottom.

A fossil imprint of a jellyfish in the Smithsonian Institution collections was pronounced the world's oldest evidence of life.

A dinosaur neck vertebra three feet across and nearly four feet long was found in Texas.

Several skeletons of *Coryphodon*, extinct hippopotamus-like animal, were discovered.

The most nearly complete plesiosaur skeleton known was found in Colorado.

Fossil termites 25 million years old were found in Germany.

Much destruction of property and some loss of life was caused by earthquakes at Colima, Mexico, on April 15, and at Cuzco, Peru, on Sept. 18.

Thirty-seven earthquakes, of sufficient severity to affect distant seismograph instruments, were recorded.

A new type of earthquake wave was discovered.

The earth was weighed at intervals of 6 miles along a traverse from Perth Amboy, N. J., to Los Angeles.

The centenary of America's first magnetic observatory was celebrated in Philadelphia.

Canada and the United States jointly undertook the preparation of an Ice Age Map.

A revision of the Geologic Map of North America was under way with cooperation of Canada, Mexico and countries of the Caribbean.

Two new theories of the earth's interior were presented: one, that it is colloid or jelly-like; the other, that it is solid, containing much dissolved hydrogen.

Measurement of geologic age of rocks by helium method was refined by discovery that retentivity of helium varies with minerals and that magnetite is most retentive.

#### ENGINEERING AND TECHNOLOGY

### Important Technical Work Among Military Secrets

Reports of progress during 1941 should be read with the realization that many important technical advances, both military and industrial, have been made but not announced due to the secrecy necessary for American defense.

A method of locating airplanes by means of radio echoes reflected from them was perfected and put into war use.

Some equipment developed by American scientists in one year's defense effort saw trial under actual war conditions.

Powder bags were made successfully from cotton instead of silk.

A new .30-caliber carbine with cartridges only half the weight of the .45-caliber pistol cartridges was adopted by the U. S. Army widely to replace the pistol.

Radio antennae that send out transmission in a searchlight beam instead of broadcasting it allowed 50,000 watt modern transmitters to send to foreign areas the equivalent of 1,200,000 watt transmitters with older type aerials.

Full color prints from Kodachrome transparencies were made available commercially.

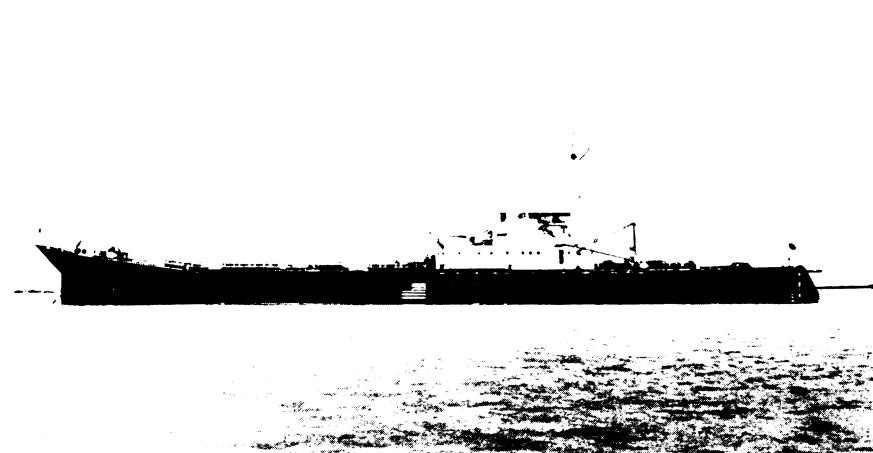
A new method was disclosed of making stereoscopic pictures by making two pictures on one film and afterwards viewing them with polarizing screens.

Million-volt portable X-ray equipment was put into industrial use radiographing boiler welds and steel castings.

Extensive telephone networks were arranged and tested to send warnings of hostile aircraft to central points and to order squadrons aloft for defense.

A radio receiver which also indicates visually the direction of an airplane from the antenna was put into service.

Direct radio telephone circuits to Lisbon and Panama were opened, radio telephone service was made available to coastal shipping along all of this country's coast line, a radio telephone system which sends twelve channels on a single transmitter was established.



### HARD TO HIT

*This new type of cargo ship, the Sea Otter II, is designed to elude submarines. Loaded, she sits close to the surface of the water—only 10 feet above and 11 feet below water line. A torpedo must travel at a depth greater than 11 feet to escape wave action.*

Frequency modulated radio relay stations were successfully used.

A coaxial cable with an ultimate capacity of 480 conversations was put in service between Stevens Point, Wis., and Minneapolis, and an 800-mile television transmission was demonstrated through this cable.

Toll calls were made by dialling the number wanted in certain distant cities.

A new high-fidelity telephone circuit for radio programs that will transmit sound vibrations up to 15,000 per second was demonstrated.

Sound control in the theater was demonstrated by which voices and music emanate from space, humans speak with animal voices and sounds are made as desired.

Copper-plating of permanent magnets used in electrical meters was shown to shield them from demagnetizing effects.

New standards for abbreviations, eliminating periods and spaces, were adopted, for example: rpm for revolutions per minute, psi for pounds per square inch, 95 F for 95 degrees of temperature Fahrenheit.

Many plastics and other substitute materials used in automobiles and other machines as a result of the defense emergency gave promise of supplanting the older materials permanently because they are better.

Powder metallurgy, making metal parts from powdered metal under heat and pressure, came into wider use.

Static electrical charges up to 40,000 volts were demonstrated on running rubber-tired motor vehicles.

Generation of electrical power began from Columbia River water impounded by Grand Coulee Dam, Wash., mightiest man-made masonry structure.

A new record for low coal consumption per kilowatt-hour for steam-electric power plants was established.

The surface of steel was hardened by a new method using synthetic urea.

Manufacturing industries spent nearly \$120,000,000, on research during the year, according to a survey.

Dr. Edwin H. Armstrong, Columbia University, was awarded the gold Franklin Medal of the Franklin Institute, for his achievements in radio, including invention of frequency modulated radio.

### MATHEMATICS

## No Sure Fire Way To Solve All Arithmetic Problems

It was proved that one can never find a sure-fire way of solving all arithmetic problems; in other words, no matter how smart we get, there will still be arithmetic problems which we cannot solve.

It was proved that every whole number is the sum of not more than 73 sixth powers of whole numbers; this is the best possible result, since it takes exactly 73 sixth powers to add up to 703.

New arithmetic properties of the generalized Bernoulli numbers were found.

New methods were discovered by means of which at least 640 million diabolic magic squares of order seven can be constructed, in addition to the 40 million which can be constructed by older methods.

The significant connection recently discovered between finite groups of prime power order and corresponding Lie algebras over a field of characteristic  $p$  was energetically developed.

A proof was given for the famous conjecture of Minkowski asserting that two quadratic forms with integral coefficients will be semi-equivalent if they are locally equivalent at every ( $p$ -adic) prime divisor.

The general theory of ideals and rings of continuous functions was considerably developed in several ways, with the proof of various representation theorems and a new proof of Wiener's theorem on the reciprocal of an absolutely convergent trigonometric series.

An important question in algebraic geometry was answered by the development of a method for smoothing out the irregularities of an algebraic structure of three dimensions.

Information was obtained regarding the structure of those subsets of a space which are unchanged by the operations of a group of transformations on the space.

There were developed numerous properties and applications of the newly-invented "fibre-bundles," figures which can be cut up into smaller pieces in certain systematic ways.

Cauchy's classical formula, expressing a function of a complex variable in terms of an integral, was significantly extended.

A generalization of the celebrated Problem of Plateau was formulated and solved, the problem in which it is required to prove the existence of a surface having a prescribed boundary and a minimum area with respect to all surfaces with this boundary.

A solution was found for the difficult inverse problem of the calculus of variations, the problem of finding conditions under which a given family of curves in space can be regarded as the family of extremals arising from minimizing an integral.

A new system of postulates for the theory of probability was formulated, based on Boolean algebra.

Problems connected with the bending and buckling of elastic plates were studied, and solutions obtained for various special cases.

### MEDICAL SCIENCES

## Bread Given Vitamin for Defense of Your Health

Standards for "enriched" white flour were announced by the U. S. Food, Drug and Cosmetic Administration, to become effective Jan. 1, 1942, and production of this flour and of "enriched" bread made with such flour, or with high vitamin yeast or with ordinary flour plus added amounts of nicotinic acid, thiamin and iron was started.

A scientific yardstick for planning an adequate daily diet was announced at the National Nutrition Conference for Defense called by President Roosevelt.

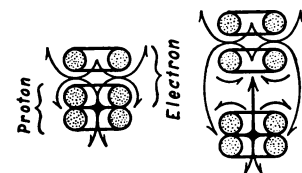
"Cure" of gray hair in humans by daily doses of a member of the vitamin B complex, para-aminobenzoic acid, was announced in a report of more than 300 cases, believed to be the first scientific announcement of cure of gray hair in humans.

Influenza A virus was photographed, for the first time, with the aid of the electron microscope which showed it to be one of the smallest disease-causing substances yet isolated, a spherical particle 11 millimicrons in diameter.

Prospects for control of influenza were improved by development of a new relatively quick test for influenza virus-neutralizing antibodies, by success in protecting against influenza A 50% of several thousand persons in six institutions by influenza A vaccine given six months before an epidemic and by development of a new vaccine against influenza A which proved even more effective in mouse trials.

First announcement of sulfadiazine spray treatment of burns showed that it promoted healing of burns more rapidly than any other method of treatment, reduced infection to less

## ESSAYS ON THE NEW VORTEX ATOM



(Neutron and Hydrogen Atom)

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C. F. Krafft, 2510 Q St. N.W., Wash., D. C.



### BRIGHT METEOR

A happy accident resulted in this photograph of what was probably one of the Leonid meteors on the night of last November 17-18. Rev. John P. Delaney, professor of physics at Loyola College, had his camera open from 7 p.m. to 6 a.m. to photograph the star paths in the north and found he had "trapped" a meteor also.

than 2% and will to some extent eliminate need for plastic surgery to efface scars and correct deformities.

Evidence indicating that domestic barnyard and wild prairie fowl constitute a reservoir of the viruses of equine encephalomyelitis and St. Louis encephalitis and that mosquitoes carry the virus was reported.

Possibility that infantile paralysis may be spread by flies appeared in a report that the virus of the disease had been isolated on two occasions from flies caught in the vicinity of excreta from infantile paralysis patients during infantile paralysis epidemics.

Largest encephalitis epidemic on record in the Western Hemisphere occurred in the Northwest during the summer of 1941, attacking more than 3,000 and killing nearly 10% of those attacked.

Encouraging results with vaccination against encephalitis and from the use of human convalescent or hyperimmune animal serum were reported in Russia.

Studies suggesting that the infantile paralysis virus invades the body through the mouth and alimentary tract or through the lungs, rather than through the nose and olfactory nerves as previously believed, were reported.

A decline in pneumonia deaths during an influenza epidemic occurred, for the first time on record, during the winter of 1940-1941.

First trials on human patients of gramicidin, germicidal substance from soil bacteria, showed it to be effective in empyema from pneumonia, sinusitis, bladder infections and staphylococcus infections in wounds.

Surgical construction of an artificial esophagus, to replace one closed by lye burns, was accomplished successfully for the second time in the United States.

Evidence that the cause of cirrhosis of the liver is poor diet, and probably a specific vitamin deficiency, appeared in many reports.

Tuberculosis patients were treated with Promin, a new chemical remedy, with results that justify continuation of the investigation.

Hope of preventing meningitis appeared in re-

ports that sulfadiazine not only succeeds as a treatment but banishes the meningococci from the patient's nose and throat, thus preventing his becoming a healthy carrier of the disease.

A record of no rheumatic fever attacks among 55 patients while taking sulfanilamide continuously from November through June each year between 1936 and 1940 was announced, giving hope that this drug might prove effective in controlling the disease by preventing recurrences.

Sulfathiazole and sulfapyridine offer a four-to-one chance for cure of gonorrhea in men within five weeks after beginning of treatment, findings in eight clinics showed.

A method of treating group O blood, the universal donor blood, to make it safer for emergency transfusion, was announced.

Studies showing that hardening of the arteries may be a condition of faulty fat utilization resulting from deficiency of the pancreas hormone, lipocaic, were reported.

Studies indicating heparin, anti-blood clotting agent, might be useful in preventing adhesions after abdominal operations were reported.

A record-breaking epidemic of measles occurred in the United States.

Deaths of two boys from bubonic plague, increase of the infection among wild rodents and eastward spread of the infection in these animals prompted the Surgeon General of the U. S. Public Health Service to call a Plague Control Conference which recommended: 1. extension of anti-plague measures; 2. appropriation by federal and local authorities of \$1,800,000 for plague control.

Sulfathiazole was reported, on basis of successful trials in mice, to be a potential anti-plague remedy.

It was demonstrated that bodily changes closely similar to those of profound pituitary-gland deficiency can be caused by chronic under-nutrition.

The urine of boys having muscular dystrophy was shown to contain large amounts of female sex hormones.

Treatment of sexual deficiency in the male was advanced by development of a synthetic male sex hormone, methyl testosterone, which is effective when given by mouth.

Existence of a potent sex hormone, estriol, which is found only in human beings, was announced.

The synthetic female sex hormone, diethylstilbestrol, was released for general medical use by the U. S. Food, Drug and Cosmetic Administration.

Encouraging results in treating the muscle weakness disease, myasthenia gravis, by surgical removal of the thymus gland were reported.

Discovery that other tissues of the body than the thyroid gland can use iodine and may convert it into a chemical like thyroxine, thyroid gland hormone, was announced.

All steroids having hormonal properties will produce narcosis if given in pharmacological doses in a manner so that they are absorbed rapidly, but steroids devoid of hormonal properties do not exhibit this action, it was reported.

For the relief of high blood pressure improved kidney extracts, renin from kidneys of animals other than that being treated, the enzyme, tyrosinase, and a new surgical operation were reported as promising but still in the experimental stage, with a five-year-progress report of an older surgical operation showing striking prolongation of life for patients with malignant hypertension.

Kidneys with reduced blood circulation liberate

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a substance which acts upon a special pseudo-globulin in the blood and the product produced by this action is responsible for the production of experimental high blood pressure, it was reported.

In vitro studies indicated that kidneys under anaerobic conditions are unable to destroy phenolic compounds which elevate blood pressure but will do so under aerobic conditions.

Possible advances in cancer treatment still in the experimental stage, included use of radio-strontium for metastatic bone cancer; a concentration method of radio-therapy for resistant cancers of mouth, larynx and pharynx; castration and female sex hormone treatment for cancer of the prostate gland; blocking blood circulation to increase skin resistance to irradiation thereby enabling use of larger doses; and, in mice only so far, use of lithium or boron-containing dyes to increase destructive action of neutron rays.

Pattern of cancerous growth may be influenced by surface forces, it was discovered from observation of cancer growth in the frog's eye.

Radio-phosphorus was announced as a promising treatment for the serious blood disease, polycythemia.

Anti-rickets action of vitamin D, it was reported, is due partly to its effect on the kidneys which it prevents from eliminating phosphorus.

Sulfathiazole ointment was reported a successful remedy for common skin diseases such as acne, impetigo, infected eczema and boils.

Transfusions of blood and sugar solutions were given by injecting into the bone marrow, a method that can supplement transfusions into veins in certain cases.

Chemical test for incipient toluene poisoning was announced.

Artificial feeding of a full meal through the veins instead of the mouth came one step closer through development of a digest of casein, milk protein, with papain, digestive ferment, which proved as effective as whole liver in promoting production of proteins in blood plasma of dogs.

It was shown that the animal organisms cannot synthesize the methyl group which therefore must be supplied in the diet. The major, if not the sole source of the methyl group is the amino acid, methionine.

With the tagged atom technique it was demonstrated that the proteins of the animal body are subject to a far more rapid, continuous process of metabolism than has been suspected.

A 5½-mile delayed-opening parachute drop furnished physiologists with valuable data on the reactions of the human body during such a terrific descent.

Two of the principal factors influencing the intensity of the symptoms of "bends" in the bodies of aviators and deep-sea divers were shown to be the total atmospheric pressure and the pressure produced by surface tension.

At pressure altitudes between 41,000 and 42,000 feet after preliminary denitrogenation and oxygen breathing, men performed physical exercise (work) equivalent to 1200 foot-pounds per minute for a full minute and a trained woman subject made a record for her sex by working for 15 seconds at 1200 foot-pounds per minute at a pressure elevation of 41,200 feet.

The hazard, in aviation, of cramps, dizziness and other symptoms caused by rapid, forced breathing when excited or frightened, was observed.

What may possibly be the first case in 30 years of laboratory-acquired infantile paralysis was reported.

Three new sulfa drugs, sulfapyrazine, sulfahydantoin, and sulfathiazolin, were announced, the last being put into clinical test because of low toxicity and high therapeutic value.

A School of Nutrition, believed first of its kind in the world, was established at Cornell University.

Discovery of an eighth member of the vitamin B group, folic acid, was announced.

A standard for oleomargarine permitting its enrichment with vitamins A and D was announced by the U. S. Food, Drug and Cosmetic Administration.

More rapid diagnosis of virus diseases seemed promised by development of a collodion fixation method for identification and typing of viruses.

Discovery of a previously unknown anatomical structure immediately below the bony floor of the middle ear and believed concerned with regulation of the blood circulation was announced.

Large scale field trials of the Cox anti-typhus fever vaccine were inaugurated in Bolivia.

An epidemic of typhus fever began to threaten Europe.

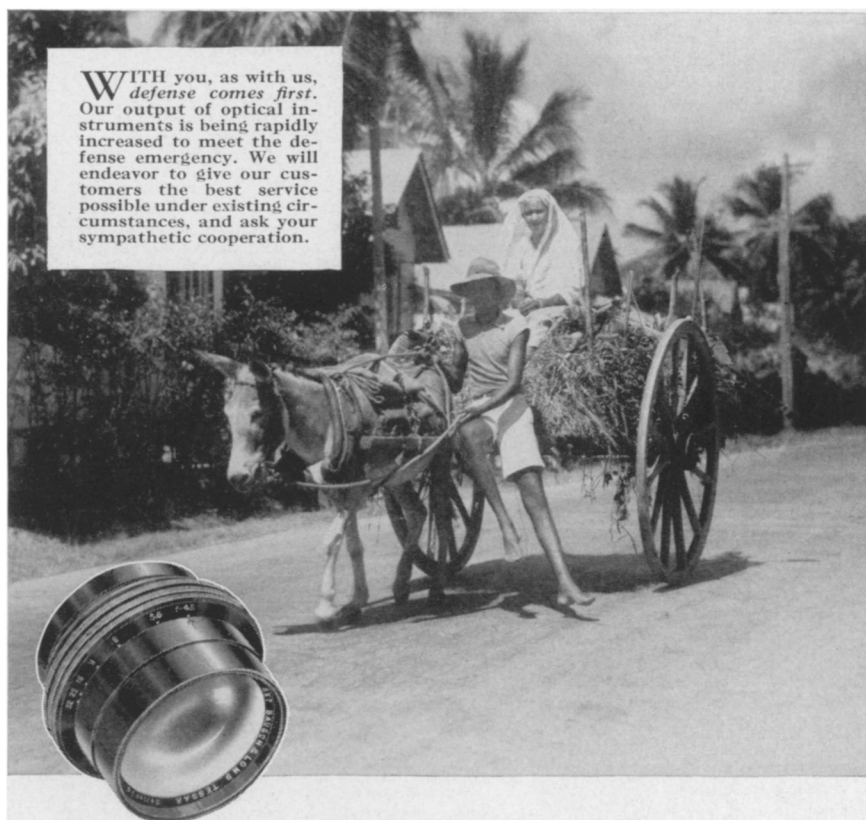
Long-time immunity to such virus diseases as yellow fever is due to the fact that the virus remains in the body after an attack of the disease, it was suggested.

A coumarin compound from spoiled sweet clover was announced as a possible effective and cheap substitute for heparin, anti-blood clotting agent.

Successful use of vitallium, alloy of chromium, molybdenum and cobalt, as plates for repair of damaged human skulls was announced.

Development in Guatemala of large plantations of cinchona trees, thus providing a potential Western Hemisphere source of quinine, was announced.

The flotation process was adapted from the



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mining industry to production of a high-vitamin, high-protein flour from wheat.

Of the 2,000,000 men called for Selective Service army training, 900,000 were rejected because of physical defects, chief of which were dental, eye, and heart and circulatory, the higher percentage over World War draft rejections for physical defects of 36% being accounted for by stricter physical examinations and non-war status which allowed more rigorous selection.

The malaria rate among troops in the United States was reduced to one-third of the 1918 rate, partly because of effective mosquito control measures carried on in nearly 100 camps, posts and stations.

To guard American soldiers against the menace of yellow-fever, the War Department approved vaccination of all troops, stationed in tropical regions of the Western Hemisphere and such vaccinations were started among soldiers in Panama, Puerto Rico and Caribbean bases.

Tests for susceptibility to diphtheria and scarlet fever, and protective inoculations for all susceptibles, were ordered for the entire personnel in Canada and Newfoundland of the R.C.A.F.

Special commissions of civilian physicians, on measles, meningitis, influenza and the like, comparable to the World War I Pneumonia and other Boards, were appointed to advise and aid the Army on control of epidemic diseases among the troops.

Laboratory Research Unit No. 1 of the U. S. Naval Reserve was called up to work on the problem of influenza control.

A highly compact, lightweight, tasty and nourishing ration was evolved by the Army for parachutists and for delivery by air to troops engaged in mobile assault operations.

Tablets containing vitamins A, B<sub>1</sub> (thiamin), B<sub>2</sub> (riboflavin), C, D and nicotinic acid were ordered as dietary supplement to troops stationed in far northern latitudes.

A Procurement Service for Physicians, Dentists and Veterinarians was established in the Office of Defense, Health and Welfare Services to help with the problem of supplying the Army, Navy and other government services with professional workers needed during the emergency.

Federal aid totalling \$1,200,000 was dispensed by the U. S. Public Health Service to 88 schools of nursing to train more nurses to meet the shortage created by defense preparations.

In military medicine the use of high concentrations of oxygen has been made practicable in the forward zone by the construction of a portable, closed-circuit type of apparatus which uses only 1 liter of oxygen per minute.

Publication was begun, by the American Medical Association, of a bimonthly journal entitled "War Medicine," edited by the Committee on Information, Division of Medical Sciences, National Research Council.

#### PSYCHOLOGY AND PSYCHIATRY

## Animal Studies Give Light On Nervous Disorders

Hope for future prevention or cure of nervous disorders caused by noise was provided by researches on noise-sensitive rats: Vitamin B<sub>1</sub> was found to prevent the rats' convulsions, glandular treatment relieved them, combination of previously harmless noise with shock caused them, and heredity was found to play a part in producing noise-sensitivity.

"Protracted shock," most dangerous complication of insulin shock treatment for mental disease, can be predicted, prevented, or, if desired, pro-

duced at will, it was found; vitamin B<sub>1</sub> prevents it or shortens duration if given after it has developed.

A method of immunizing against epileptic seizures was suggested when it was found that a seizure intentionally induced by electric shock in the safety of a physician's office makes the patient temporarily resistant to recurring seizures.

The violent convulsions accompanying metrazol treatment of mental disease were softened, and in some cases the muscular contractions abolished entirely, by use with the metrazol of the easily obtained medicine, epsom salt, or pyridine and some of its derivatives.

The electric shock treatment used for mental disease (passage of current through brain for very short time) was demonstrated to cause a partial loss of memory in the patient, particularly for events occurring just before the shock.

Electric shock therapy was used increasingly to supersede insulin and metrazol shock therapies in the treatment of some mental diseases.

New knowledge about the value of the vitamins in the treatment of some acute mental diseases and neurological disorders, not only some alcoholic psychoses but some delirious states usually attributed to senility, was discovered.

An Advisory Council on Nervous and Mental Diseases was appointed by the Surgeon General of the U. S. Public Health Service, and establishment of a National Institute for Research on Nervous and Mental Diseases was recommended.

Warning that extreme caution is necessary in use of X-rays on women who might be pregnant was seen in the discovery that microcephalic idiocy in an unborn child followed X-ray treatment of the mother for a supposed tumor.

Fixed abnormal habits in rats were not broken up by dosage with metrazol even when convulsions were produced, a finding which affects present theories on how the drug acts to cure mental disease.

Deprivation, even though resented, makes a group more united and cooperative, but less constructive, experiments on child groups revealed.

Anxiety can persist and cause the learning of new peculiar habits long after the original cause for fear is gone, it was demonstrated by animal experiments.

A fourteen-year study of identical twins demonstrated that both physical and mental traits of individuality persist from infancy into adolescence.

The Rorschach test, well-known ink-blot test of personality and imagination, was adapted for group use in order to make it available for selection of military personnel.

Gasoline vapor, used as an anesthetic, has effects similar to those of alcoholic vapors, it was found in experiments on animals and a human subject.

New light on a vitamin deficiency disease, in humans associated with alcoholism, was provided by the discovery that fishes and foxes suffer an identical ill when over-fed on raw fish.

Short tempers, inefficiency, inattention, uncertain memory and confusion of thought were found to result from a diet only slightly low in vitamin B<sub>1</sub>, but continued over a period of months.

Alcohol was found to reduce the ability of the body to respond to severe exposure to heat.

Progesterone, a sex hormone, was used successfully to reduce sexual excitability in monkeys and was recommended to physicians for trial on women patients in need of temporary medical aid.

The abstraction ability to sort by color, believed a function of the important frontal lobes of the brain, was found in monkeys, which may therefore be used experimentally to learn more

about the usefulness of this brain area. Children short for their age were found to average low in intelligence while those tall for their age average high.

Study of mental growth indicated that it may continue slowly even after the age of 20.

Learning of the simple type known to psychologists as "conditioning" is slowed but not eliminated when the important brain cortex and sub-cortical parts of the nervous system are "knocked out" by the drug nembutal, animal experiments showed.

Doubt regarding the exact function of the brain's important frontal lobes was raised by experiments showing that monkeys without this brain area can remember where to reach for food even after a ten-second delay.

Sex drive in rats was found to be below normal if the animal loses any large amount of the brain cortex.

By the learning process known as conditioning, it is possible to gain the ability to interrupt the brain waves—electric impulses originating in the brain cells.

Eight persons were conditioned to control at will changes in the electric resistance of the skin, an apparently unconscious and involuntary reaction.

Quantum theory was successfully applied to sensory experiences, particularly hearing and vision.

A change in only eight or nine molecules of the visual purple in the eye's retina was found to be sufficient to produce a visual sensation.

Steady pressure on the skin ceases to be felt as soon as the skin ceases to yield to the pressure and reaches a state of equilibrium, it was found.

The excitement of powerful emotions was found to affect the way in which the two eyes work together in the perception of distances and depth, important in the testing of military pilots.

Color blindness was reported partly corrected by dosage with vitamin A.

The same tone is perceived as of slightly different pitch by the two ears of even normal-hearing persons, it was reported.

Bats' ears were found sensitive to high-pitched sounds above the limits of human audibility, and they guide themselves by echoes of their own supersonic cries.

Fatigue produced by highly skilled tasks was found to have different psychological effects from that caused by simple monotonous tasks; accurate timing is the first ability to break down.

Organized study of the food habits of Americans was begun by a committee of anthropologists and psychologists, cooperating with a parallel committee of biologists and nutritionists.

Prof. Clarence H. Graham, Brown University, was awarded the Howard Crosby Warren Medal by the Society of Experimental Psychologists for his research in the field of vision.

A non-profit organization for the impartial study of problems in polling public opinion was established.

Conditions necessary for maintenance of high national morale were studied by psychologists pooling their talents and research resources.

Listening posts were established to record and analyze radio propaganda and methods of classification and interpretation were developed.

A new branch of psychology—military psychology—was recognized when the Army started a school to train scientists in this profession.

Documents dealing with German psychological warfare were assembled and analyzed and intensive study of this field was made cooperatively under direction of two committees.

Psychological research centers were established at flying fields of the Army Air Corps.