

REVIEW OF THE YEAR

Science Progressed in 1939

GENERAL SCIENCE

Splitting of Uranium Atom With Hint That Power May Be Unloosed Led All Events of War-Darkened Year

By SCIENCE SERVICE STAFF

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 24 and also the issue which will appear next week, December 30.)

LONG after the war of 1939 is forgotten the splitting of the uranium atom with release of energy, hinting practical production of power from within the atom, may be listed as the year's outstanding achievement.

In the air, wings across the Atlantic, 500-miles-per-hour planes in the making. From the past, the oldest dated American monument; a Neandertal skeleton from Turkestan. From the sky, new stellar super-explosions, an unusual number of comets. In the realm of life, a deep-sea fish supposedly extinct since the dinosaurs. For our health, more chemical conquests of disease. For our minds, quickened appreciation of propaganda's effect.

These are highlights in science's 1939 progress, dimmed by war's insistent demands.

Science Service's annual survey of science shows these outstanding accomplishments and events:

AERONAUTICS

Regular Passenger Service Across Atlantic Started

Regularly scheduled passenger and mail service across the Atlantic by air became an actuality in 1939 when the Pan-American clippers went into service.

The two most powerful airplane engines ever built, the 24-cylinder Allison Senior and the 18-cylinder air-cooled Wright radial engine, were exhibited at the New York World's Fair.

Research at Langley Field, Virginia, looked toward a new airplane wing design suitable for 500-mile-per-hour speeds.

The DC-5, a 16-passenger baby skyliner for small airport and feeder line use, and fitted with a new high wing and tricycle landing gear, took the air.

Huge 60-ton flying boats with 5,000-mile range and 200-mile-an-hour speed were designed in France for future transatlantic service.

A new twin-engined American attack bomber with a reported speed of nearly five and a

half miles a minute with a half-ton bomb load, made its maiden flight.

The smooth-as-glass wing and fuselage with flush rivets went into commercial production.

The "basket weave" construction for airplanes, using the radically new geodetic principle of design was put into large scale production in England.

Airplanes intended for 25,000-foot altitudes were in production.

A new seadrome light giving the illusion of a stationary light although tossed by waves was accepted in Navy tests, giving new opportunity for night flying over water.

A robot pilot was developed to warn the pilot if his instruments are not set correctly for any desired operation.

A method was developed for taking wind soundings at night with a balloon firing magnesium flares at frequent intervals and a 180-degree camera to record its progress.

A fixed slot near the lead edge of the wing on two types of airplanes acted as safeguard against stalling and loss of control at the stall.

A wing flap with double slots was developed to increase the lift on the wings and make flying possible at slower speeds.

Plastics came into experimental use for light weight propellers with plastic covering and in wings and other airplane parts made by molding plastic-bonded plywood sheet around formers.

Steps were taken to standardize airplane and engine parts and fuel specifications.

Theoretical and experimental studies afforded means for airplane designers to predict or avoid undesired spinning characteristics.

An electric resistance technique was developed for measuring stress in airplane and propeller parts under operating conditions.

Nylon, synthetic fiber made from coal, air and water, was tried out for use in parachutes.

New shoulder straps were devised to protect the pilot against head and neck injury in jackknifing during crashes, dives or aerobatics.

An automatic device was developed to drive the motors of a multi-engine airplane at exactly the same speed and eliminate bumpy "beats" while flying.

An experimental station for developing new and better radio navigation methods was formally opened by the Civil Aeronautics Authority.

Construction was begun on a new research laboratory of the National Advisory Committee for Aeronautics near Sunnyvale, Calif.

Two new wind tunnels of the National Advisory Committee for Aeronautics at Langley Field, Va., were dedicated.

Canada acquired a site for an air research station.

The first university course in rotating wing aircraft engineering was established.

Aviation training under the C.A.A. was begun in 435 colleges.

Training of thousands of aviation mechanics was undertaken under the auspices of the National Youth Administration.

Two airmail routes from Pittsburgh to Philadelphia and to Weston, W. Va., inaugurated a pick-up service for small cities along the route where mail and air express were taken on and discharged without a landing.

The first autogiro air mail line started shuttling mail between Camden airport and the Philadelphia post-office roof.

An American airplane base was established on Canton Island, in the Pacific.

ANTHROPOLOGY AND ARCHAEOLOGY

Neandertal Boy's Skull Found in Central Asia

Entering at Tanis the tomb of Pharaoh Shishak I, plunderer of Solomon's Temple in Jerusalem, archaeologists found the place undisturbed and the Pharaoh enclosed in silver and gold coffins.

First discovery of Neandertal Man in Central Asia was reported in 1939, the skeleton of an eight-year-old boy, unearthed near Tashkent, Turkestan.

The oldest known dated monument in America, the equivalent of 291 B.C. by one correlation, 31 B.C. by another, was discovered in Tres Zapotes, Mexico.

Nestor's Palace of Odyssey fame was found on the Promontory of Pylos, and in the ruins lay hundreds of archives in Cretan-like script.

The impressive ship grave of an Anglo-Saxon king, probably Redwald who died about 620 A.D., came to light in Suffolk.



IMPORTANT DISCOVERY

The skull of an 8-year-old Neandertal child, first of his ancient race to be found in central Asia, has provided Soviet scientists with material for showing what the young hopefuls of Stone Age parents looked like, in that part of the world 50,000 years ago.

A Bureau of Human Heredity was established in London to collect data on inheritance of human traits.

Measurement of 147,000 American children provided the clothing industry with its first scientific basis for sizing children's clothes.

First nation-wide survey of hair traits in the United States was initiated by anthropologists.

With 50,000 Tarascan Indians as a test group, the Mexican government launched its new policy of educating Indians in their own languages, rather than Spanish.

"Melanoid," hitherto unknown coloring matter, was detected in skins of all races by means of a new optical instrument, the recording spectrophotometer.

Hailed as a new and important link between man and ape, a distinctive fossil tooth found at Sterkfontein, South Africa, was believed allied to remains of the man-ape of 50,000 to 100,000 years antiquity previously found in the same district.

An extraordinarily well preserved Neandertal skull with well-developed brain capacity was unearthed on the west coast of Italy.

Seven skeletons of "modern mankind" which had been found in the cave of Peking Man, China, were scientifically described and pronounced surprisingly varied with the inclusion of Indian-like types.

A village unearthed in Arctic Alaska revealed a form of prehistoric Eskimo life quite different from anything previously seen.

Beads and additional types of tools were found at the only known camp of Folsom Man in Colorado, clarifying the picture of earliest Americans as equal in culture to Stone Age Europeans of the same era.

The official report of the United States De Soto Expedition Commission provided scientific background for the 400th anniversary celebration of 1940-1943.

Indian graves and settlements unearthed in various parts of the United States included: A village and burying ground on Frontenac Island, N. Y.; site of Patowomeke, Virginia, scene of Pocahontas' kidnaping; burial of a much-honored medicine man in Arizona; pit house villages of the little-known Mogollon culture in Southwest; remains of Indian life in the Mississippi Valley preserved at Kincaid site, Illinois; settlements in area destined to be submerged by TVA construction, and from which valuable data on Southeastern Indians are being salvaged; a "crossroads" where three early Indian cultures left traces of their presence in Texas.

The verdict that two of Mexico's most famous ruins, Monte Alban and Mitla, were built by Indians of the same cultural heritage was reported on the basis of architectural similarities.

Tree-ring technique of dating pueblo ruins in America was reported applicable to certain Viking and pre-Viking sites in Scandinavia; also to New England sites.

Twenty burial mounds examined in Soviet Georgia led to announcement that they represent an important, hitherto unknown center of European civilization of about 2000 B.C., with Iranian, Hittite, and Aegean influences.

Life of refugees when Crete's civilization fell about 1100 B.C. was shown by excavation of a city of refuge on Mount Karphi, Crete.

Near Mycenae, Greece, the tomb of a queen who lived about 1400 B.C. was found undisturbed.

Exploration of a royal chamber tomb of the Mycenaean age in Athens showed that before the Trojan War era that city was rich and important.

Final discoveries at Pergamon, ancient world

health resort, were reported, following completion of long excavations there.

Great antiquity of civilization in Cilicia was inferred from excavations at a many-layered mound near Tarsus, apparently inhabited as early as 6000 B.C.

Excavations at Lachish yielded the first known workshop of a Bible potter, also a clew for dating Joshua's conquest of the Canaanite city near 1230 B.C.

Underground arrangements of the Colosseum in Rome were explored.

Evidence that Egypt's astronomy was rudimentary compared with that of Babylonia was provided by Egyptian writings.

Despite unsettled world conditions, expeditions continued unearthing ruins at Armageddon, King Solomon's seaport of Ezion-geber, Jewish catacombs at Beth Shearim, the city of Van in Turkey, Olympia in Greece, Ostia in Italy, to name a few notable sites.

ASTRONOMY

82-Inch Telescope in Use; View Corona by Television

The McDonald Observatory 82-inch telescope, second largest in the world, was put into use on Mt. Locke, Texas.

Television apparatus was devised to detect activity in the sun's corona without waiting for total eclipse, promising aid to forecasts of disruptions in intercontinental radio communications.

A new optical method of testing telescope mirrors, using a wire instead of knife-edge, gave promise of reducing to a third the labor and time for grinding such mirrors.

An unusual number of comets, 6 new and 7 returns of periodic comets found in previous

years, were discovered: Kosik-Peltier, periodic Pons-Winnecke, Vaisala, Jurlof-Achmarof-Hassel which came to naked eye brilliance, periodic Kopff, periodic Schwassmann-Wachmann, periodic Brooks II, Rigollet, Kaminsky, periodic Tuttle, periodic Giacobini-Zinner, Friend, periodic Faye.

Five more supernovae, tremendous super-exploding stars, were discovered in distant nebulae; occurrence of three such recent outbursts in one nebula within 16 years suggested that in some galaxies a tenth of the stars may explode in a time equivalent to the period since the earth's rocks cooled.

Solar activity remained at a high level during the year, with sunspots totaling more than 200 on many days, auroral displays of unusual intensity and interference with long distance radio communication.

A sunspot cycle of 89.36 years was reported.

The collision theory of the birth of the solar system, arising from a star sideswiping the sun ages ago, was questioned.

The queer spectra of super-novae were interpreted.

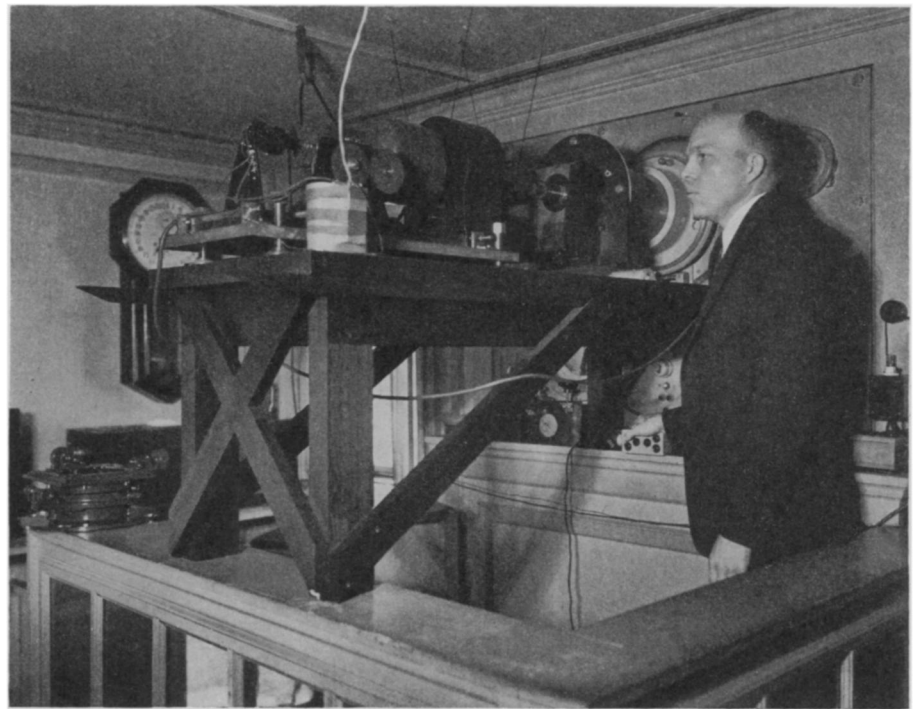
Mars made the closest approach to the earth in 15 years, Jupiter came nearer the earth than in 24 years, Saturn came closer to earth than in 20 years.

More extremely dense "white dwarf" stars, one with a weight of 9,000 tons per cubic inch, were the first discoveries made with the new McDonald Observatory telescope.

Harvard Observatory's 10,000th variable star was discovered.

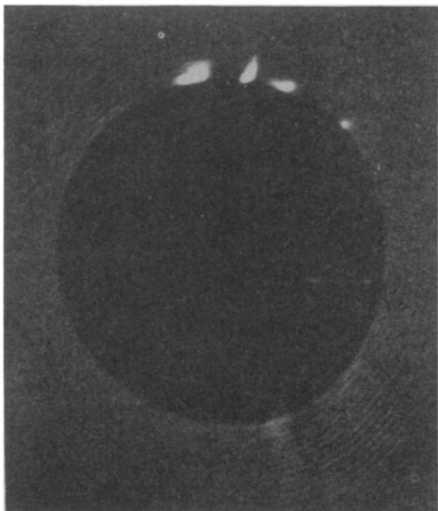
A gigantic aura of stars was discovered enveloping our own universe of stars, the Milky Way.

Space between the stars was found to contain oxygen, and about as much matter as all the stars.



CORONAVISER

Dr. A. M. Skellett, of the Bell Telephone Laboratories, is here operating his new instrument for observing the solar corona without waiting for an eclipse. It is a television apparatus which "traps" the glaring light from the sun and transmits only the astronomically interesting glow of the corona.



SEEN WITHOUT ECLIPSE

This is how the solar prominences look as viewed with 1939's gift from radio to astronomy, the coronaviser. (See facing page.)

Hydrogen is the fuel and helium the ash of stellar brilliance according to theories that postulate releases of vast amounts of energy through atomic synthesis.

Some bright stars were found to have atmospheres extending millions of miles beyond their visible portion.

Hydrogen, chief source of the sun's energy, was estimated to be sufficient to last for at least 35,000,000,000 years.

The mechanism of energy generation in stars was worked out.

The chemical composition of planetary nebulae has been found to be the same as that of the sun.

Iron, ionized six times, was found to be responsible for previously unidentified spectrum lines in Nova Pictoris.

BIOLOGICAL SCIENCES

Find Fish Thought Extinct Since Days of Dinosaurs

One of the big biological events of the century was the discovery, off the eastern coast of South Africa, of a large, deep-sea fish belonging to a group supposedly extinct since the days of the dinosaurs. The scaly monster, about five feet long and having huge blue eyes, has been given the scientific name *Latimeria chalumnae*.

Two human embryos, only eleven days old, were studied.

Light, either artificial or from the sun, serves to increase the ability of plants to withstand midsummer heat, experiments showed.

Undifferentiated plant tissue was induced to grow indefinitely in test tubes.

A new genus of palm found on Cocos Island was named *Rooseveltia frankliniana* in honor of the President.

Oxygen requirement of a fertilized mammalian egg was found to be 0.00073 cu. mm. per hour.

A new method was devised for measuring soil moisture, by passing electric current through a buried block of gypsum.

A chemical necessary for the capture of carbon dioxide in food formation by plants was discovered.

Iodine was found necessary for plant growth. Seedless watermelons were produced by chemical treatment of unpollinated flowers.

A plant-growth-retarding substance was discovered.

A substance that makes plant wounds heal was discovered, and named traumatic acid.

Legs were successfully cross-transplanted among embryos of chickens, turkeys, ducks and other fowl.

Colchicine was extensively applied in the breeding of new varieties of plants.

A new type of rubber cavity filling for tree wounds was designed to provide an inexpensive treatment.

By embedding grass seed in a batter of flour, mud and manure, a South African scientist got "amazing results" in regrassing bare Veldt.

Among the passengers on the Atlantic Clipper's first return flight from Europe were 100 parasitic insects, imported to fight the asparagus beetle pest.

A new cooperative system for artificially inseminating cows, ewes, and other farm animals was inaugurated in several states.

The deadly plague that is killing persimmon trees was found as far west as Oklahoma.

A new virus disease of elms killed many trees in the Ohio valley.

Spraying apples with a thiocyanate compound gives them red cheeks, it was discovered.

Breeding of a wilt-resistant alfalfa, to be ready in 1942, and of a wheat resistant to rust, bunt and Hessian fly, to be ready in 1943, was announced.

The pituitary gland was found to be the primary factor that sends hibernating animals into their winter sleep.

Gland extracts from carp injected into female rainbow trout shortened the spawning process, providing hatcheries at planting time with young fish two months more mature and sturdy.

Marking migrating butterflies for identification, by gently pressing an inked stamp on the wing, was tried.

The U. S. Government made arrangements for the promotion of agricultural research in South Africa.

CHEMISTRY AND PHYSICS

Splitting of Uranium Atom Gives Promise of Energy

Outstanding research accomplishment of 1939 in the fields of physics and chemistry was the discovery that enormous amounts of atomic energy could be released by the splitting of uranium atoms when they are bombarded with neutrons. While the original discovery of uranium fission was made in Germany, scientific laboratories in America and throughout the world quickly confirmed it in feverish weeks of research activity. By the end of the year quantitative experiments indicated that for each uranium atom split there was released 175,000,000 electron volts of energy.

Among the specific discoveries on the fission of heavy elements by neutron bombardment were: The discovery that thorium and protactinium can likewise be split and made to release atomic energy.

The fission of uranium was found to be accomplished by the emission of other neutrons in a delayed reaction which may be the link in a chain reaction that potentially would make

possible the practical release of uranium's atomic energy.

Barium, krypton, antimony, tellurium, iodine, strontium, yttrium, lanthanum, xenon, caesium, and rubidium are among the elements found to be created by the splitting of uranium with the release of large amounts of energy.

The heat produced by the release of atomic energy in uranium's fission was used to create a chemical reaction in nitrogen iodide.

A delayed emission of gamma radiation in uranium fission, and an indication that perhaps three or more splitter products (instead of the usual two) might be given off in this action, was reported.

Other advances of the year were:

Experiments showed that the work of extracting an electron from tungsten (electronic work function) which usually is assumed to be a constant in classical theory actually varies with temperature amounting to an increase in energy of .00006 electron-volts for every increase of one degree Centigrade.

A new type of chemical reaction obeying the laws of chance and operating between compounds hitherto believed to be inert to one another, as cream and milk, was discovered.

The most sensitive current-detecting device ever created was developed which can detect .000,000,000,000,000,001 amperes, or a current equal to a single electron passing down a wire every five minutes.

Density, temperature and other important facts about the atmosphere up to heights of 24.8 miles were determined with a flickering searchlight and photoelectric cell detectors.

The world's most powerful continuous magnetic field, with a strength of 100,000 gauss, was created.

An improved and simple way of producing thiodiglycol, starting material in the manufacture of mustard gas, was developed.

Hydrogen fluoride was discovered to be an excellent catalyst for many vital organic chemical reactions, improving the yield of many reactions and making possible some which have not previously been attained.

A new synthetic silk-like fiber made from polyvinyl acetal resin, and known as Vinyon, approached commercial production.

Optical glass having the highest index of refraction (light bending ability) and the lowest dispersion ever attained was patented.

The speed of light, fundamental physical constant, was determined for the first time by a completely automatic method that makes the observations independent of the observer.

The new 200-ton cyclotron of the University of California was placed in operation; one of its first research tasks was the measurement of the magnetic moment of the neutron.

Plans for a 2,000- to 3,000-ton cyclotron for smashing atoms with energies of more than 100,000,000 electron volts were announced.

A water-repellant chemical for fabrics which will withstand laundering, was developed.

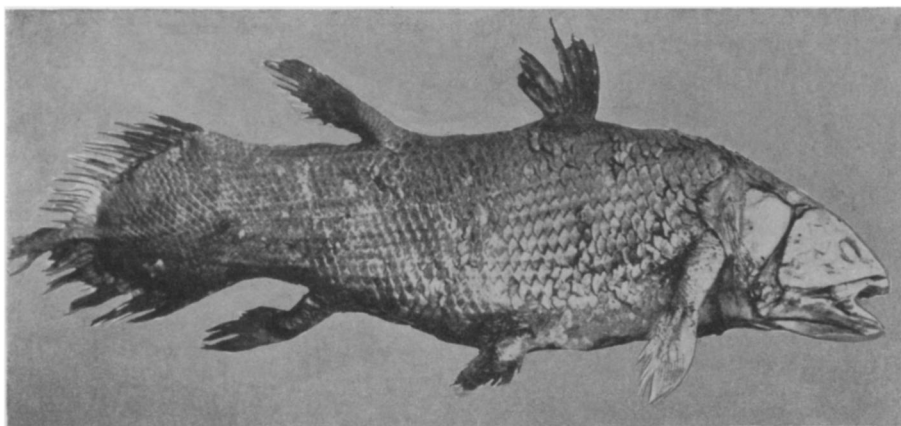
One of the longest lived of all artificially radioactive elements was created, an isotope of iron, with a half life of more than ten years.

The magnetic moment of the deuteron was determined and found to be quadrupole in nature.

A new type of glass which can be heated cherry red and then plunged into ice water without cracking was developed.

The mean "life" of the mesotron, atomic particle with mass about 100 times that of the electron, was shown to be 25 ten millionths of a second.

Balloon flights in Panama (Turn to Page 412)



"EXTINCT" FISH FOUND IN 1939

Almost like finding a live dinosaur was the discovery of this strange fish, captured early in the year off the eastern coast of South Africa. It belongs to a family supposed to have been extinct for millions of years. It is now the prize possession of the East London, S. A., museum, whose curator, Miss Courtney Latimer, has been made its scientific godmother: its generic name is *Latimeria*.

PHYSICS

Powerful Electron Microscope Magnifies 12,700 Diameters

Photographs Taken With New Toronto Instrument
Are Further Enlarged by Photomicrography to 180,000

WHAT is believed to be the world's most powerful microscope, capable of magnification of 12,700 diameters, has been developed at the University of Toronto by Drs. E. F. Burton, J. Hillier and A. Prebus. (*Physical Review*, Dec. 1)

The Toronto apparatus is an electron microscope in which high speed electrons fly down a large vacuum tube, penetrate thin layers of the material being examined and then fall on a photographic plate. Pictures of what colloidal gold looks like at a magnification of 12,700 diameters are shown in the scientists' report. To make the pictures suitable for magazine reproduction they are enlarged still further, by photomicrography, until the total magnification amounts to 180,000 diameters.

This additional enlargement is not the crucial magnification of the instrument, determined by its resolving power which amounts to 60 Angstroms, or 0.00006 of a millimeter.

The best previously reported resolutions of electron microscopes have come from Germany claiming resolution of 0.00001 of a millimeter.

Most powerful microscope of the ordi-

nary optical type is that announced in 1938 by Drs. E. C. Dane, Jr., and L. C. Graton of Harvard University which—while capable of total magnification of 50,000—had a limit of resolution of 6,000 diameters. The new Toronto electron microscope exceeds this magnification by over 2.5.

Dr. V. K. Zworykin, scientist of the Radio Corporation of America and authority on the construction of electron devices, has placed the theoretical resolving power of electron microscopes at 0.000001 of a millimeter. Thus the Toronto apparatus is only six times above this limit.

Science News Letter, December 23, 1939

MEDICINE

New Syphilis Medicine To Be Taken in Pills

A NEW syphilis medicine which can be taken in pills has been developed by Dr. Paul J. Hanzlik and assistants of Stanford University School of Medicine.

Success with exacting trials of the drug for over four years, in syphilis

clinics in San Francisco, Los Angeles, Cleveland, and Philadelphia, was announced recently. At the same time the American Medical Association in Chicago announced that its council on pharmacy and chemistry has accepted the new medicine as an anti-syphilitic agent.

Sobisminol is the name of the new syphilis medicine. It is a bismuth compound. Its great advantage is that it can be taken in pills, or capsules, at home, thus cutting down the number of visits to clinic or doctor's office and, of course, making unnecessary the hypodermic injections of bismuth which have been part of syphilis treatment.

The new medicine, however, is not a short-cut to a syphilis cure. It must be taken in combination with injections of arsphenamine or one of the other arsenical compounds. The total course of treatment still takes nearly two years, made up of alternating periods of six to 10 weeks of weekly arsphenamine injections and 10 to 20 weeks of taking the sobisminol capsules.

The new medicine will be sold on a physician's prescription only. Bismuth, the active ingredient, is a poison which is not safe for patients to prescribe for themselves. The new medicine is protected by patent held by Stanford University and the licensing agreements already made with three drug manufacturing firms restrict the sale of the drug without prescription and also forbid its exploitation to laymen by newspaper advertising, radio, or window displays. Royalties will be used for further research in syphilis and related problems.

Sobisminol is said to produce quite prompt healing of syphilitic lesions and to have a killing effect on syphilis germs

● RADIO

"Adventures in Science" with Watson Davis, director of Science Service, over the coast to coast network of the Columbia Broadcasting System, will be augmented with special programs due to the many scientific meetings during the Christmas season.

Monday, Dec. 25, 4:30 p. m. EST, Watson Davis will present the highlights of the year in science, speaking from Washington.

Tuesday, Dec. 26, 6:15 p. m. EST, Dr. Wesley C. Mitchell, retiring president of the American Association for the Advancement of Science, will discuss public relations of science. Introduction by Dr. Walter B. Cannon, president. From Columbus.

Friday, Dec. 29, 4:00 p. m. EST, Dr. F. R. Moulton, permanent secretary, A.A.A.S., will join with Watson Davis in interviewing leading scientists attending the A.A.A.S. meeting. From Columbus.

Monday, Jan. 1, 4:30 p. m. EST, Watson Davis, director of Science Service will forecast advances of science for 1940. From Washington.

Listen in on your local station. Regular programs will continue each Monday, 4:30 p. m. EST, 3:30 CST, 2:30 MST, 1:30 PST.

in the blood and tissues. Because of its ability to penetrate the brain and nervous system, it has been found to bring relief from pain in a high percentage of cases in the late stages of neurosyphilis. One physician who used it in treating patients reported that if used early in syphilis it "may prove to be of value in the prevention of neurosyphilis."

The feat of producing a bismuth compound for oral treatment involved making a hypothetical chemical compound which had never been actually manufactured. This is triisopropanolamine, which is combined with sodium bismuthate and propylene glycol to make a bismuth compound that can be absorbed from the stomach into the blood, which is stable enough to withstand chemical action in the digestive system, and which prevents heat coagulation of the blood.

Science News Letter, December 23, 1939

PHYSIOLOGY

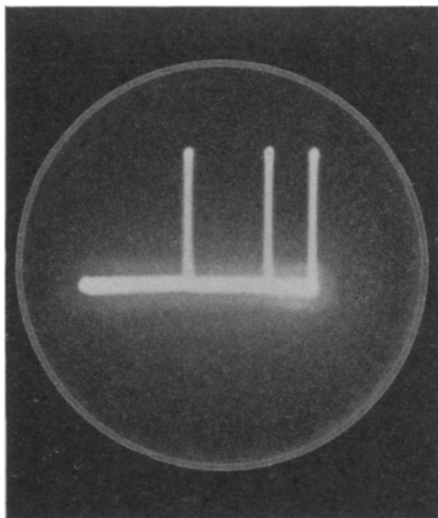
Miss and Mrs. America Are Growing Slimmer

MISS and Mrs. America, congratulations! You are getting thinner, judged not by any illusion of fashions but by very factual, unemotional insurance pounds.

For many years the public has been steadily bombarded on the perils of obesity. Sound health reasons—overweight promotes higher mortality and more illness from diabetes and chronic degenerative diseases of heart, kidneys, circulatory system generally—were reinforced by dictates of dress, the athletic figure becoming popular.

The propaganda did its work. The scales of the Metropolitan Life Insurance Company examiners show a decline in the average weights of women, 1932-34 compared with 1922-23, for almost every height at every age . . . not large . . . usually 3 to 5 pounds . . . but weightedly conclusive.

Science News Letter, December 23, 1939



OUTSTANDING DISCOVERY

The splitting of uranium atoms with slow neutrons and with the release of enormous amounts of atomic energy led the achievements of 1939. When the energy is detected and put into an oscillograph, electrical pulses can be seen which closely resemble those shown here.

From Page 405

to the height of 70,000 feet showed that the "hard" component of cosmic radiation consists of mesotrons, while the "soft" component consists of electrons, either positive or negative.

The "birth place" of mesotrons was shown to be within the earth's atmosphere at altitudes above 14,000 feet.

Ions of hydrogen and perhaps even heavier atoms flying into the earth's atmosphere from outer space were suggested as the cause of the newly found mesotron particles.

Chemists were able to obtain 1 1/5 gallons of gasoline out of each gallon of crude oil by newly developed hydrogenation processes.

Research seeking to produce artificially the red coloring matter of the blood, hemin, led to a new class of chemical compounds.

A new kind of bacteria was discovered which ferments kerosene into ethane and methane.

By using a "tunnel" through a tank of water, a partial collimation of neutron beams, much needed in nuclear physics, was obtained.

Relatively large amounts of the heavy isotope of carbon were produced by chemical separation.

The highest useful pressures ever created in

the laboratory, 1,500,000 pounds to the square inch, were produced.

Two new explosives, nibglycerol trinitrate and nibglycol dinitrate, were produced out of the abundant raw materials of natural gas or coal, air and steam.

Thermal diffusion methods for the successful separation of isotopes were developed.

New indirect evidence suggesting the presence of the elusive neutrino particle, having the mass of an electron but without electrical charge, was reported.

Electrons were used to create atomic disintegration for the first time.

Triple weight hydrogen of mass three was made and found to be radioactive.

Large numbers of neutrons were discovered at altitudes of 70,000 feet by balloon experiments.

Variations in cosmic ray intensity have been found at high altitudes and attributed to the magnetic field of the sun or some other non-terrestrial cause.

A radiation pyrometer has been developed which measures ordinary temperatures without influencing the temperatures measured as former instruments have done.

Practical methods were developed for coating glass surfaces to eliminate unwanted reflections of light.

Sodium pentachlorophenate was introduced to preserve liquid rubber latex for long periods.

The speed of lightning strokes was found to be more than 22,000,000 miles an hour.

"Clouds" in the ionosphere radio reflecting layer, which attain velocities as great as 310 miles an hour, were demonstrated.

Five useful chemical products were created out of lignin, former waste product of wood.

A new electrical micrometer made possible measurements with an accuracy of .000005 of an inch.

An improved method of bombarding living materials with electrons of homogeneous energy was developed.

The world's most powerful magnetic alloy steel was developed and when used in a magnet, half the size of the eraser on a lead pencil, lifted five pounds.

An automatic electrometric titration apparatus was developed for analyzing chemicals.

A new method of making hydrogen peroxide was developed which requires only a third as much electrical energy as older processes.

Four, and possibly six, new types of soap solutions, some with potential commercial importance, were discovered.

The four new regional industrial research laboratories of the U. S. Department of Agriculture were dedicated, and organization of their staffs was commenced.

EARTH SCIENCES

Government-Sponsored Party Starts to the Antarctic

A Government-sponsored American expedition to Antarctica set sail in 1939, equipped with planes and a specially built snow cruiser, to amass geologic, geographic and oceanographic data and to collect zoological specimens and information.

A new method was developed for obtaining geologic data on the deep bottom of the ocean by means of TNT explosions.

A new type of "robot" unmanned observatory made possible the obtaining of weather

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data in remote and inaccessible places, like exposed mountain tops and the polar regions.

The U. S. Weather Bureau made two innovations: "breakfast time" radio broadcasts, and combination aviation and general forecasts made at airfields.

A numerical code for reporting weather was put into use by the U. S. Weather Bureau.

A large iron meteorite was found in Modoc County, Calif.

There were more than 35 earthquakes of sufficient severity to be registered on the world-wide network of seismograph instruments.

A new type of earthquake wave, acting diagonally, was discovered.

After a nearly normal summer, an unprecedented autumn drought gripped most of the country.

The North Atlantic iceberg season was the longest on record.

A destructive storm struck the California coast in late September, causing severe local floods and a number of shipwrecks.

Drought in Japan and Korea caused crop failures and serious shortage in electric power.

China's Yellow River added the miseries of a great flood to the devastation of war.

The first submarine charts of the eastern coast showing depths out to some 10,000 feet with all soundings incorporated in submarine contours were issued.

Natural forces worked rapidly toward the repair of shoreline damage done by the New England hurricane of September, 1938.

The great volcanic explosion that formed Crater Lake occurred after North America had human inhabitants, new evidence indicated.

A submarine peak, rising nearly two miles above the ocean bottom, was discovered in the Gulf of Alaska.

A new "deepest spot" for the Atlantic, 5.7 miles, was found in the Nares Deep, north of Puerto Rico.

The glaciers of the Sierra Nevada are only about 4,000 years old, half the age formerly accredited to them, it was suggested by new evidence.

The biggest sea-monster skull ever found, the 10-foot head of a 60-foot plesiosaur, was brought to this country.

The "mummy" of a duckbill dinosaur was studied at the Smithsonian Institution.

A fossil skull belonging to a huge bear-like creature of Oligocene geological time, about 50,000,000 years ago, was discovered in Saskatchewan.

ENGINEERING AND TECHNOLOGY

Extracting Manganese From Low Grade Ore Made Easier

A practical way of extracting the important metal manganese from low grade ores was developed in 1939; also the use of small amounts of lead in steel to improve greatly its fabrication properties.

The U. S. Navy opened its new \$4,500,000 towing tank at Carderock, Md.

Gas turbines which in wartime emergency can be buried underground with only fuel and air inlet and an electric cable outlet, were developed in Europe and already several are in operation in the United States in industrial plants.

Commercial production was begun of high test gasoline, using sulfuric acid as the chemical catalyst.

A 100-kilowatt radio broadcasting transmitter with directional antenna which was "aimed"

at South America was placed in operation.

The S. S. *America*, 30,000-ton passenger liner, the largest ever built in America, was launched.

A 608,170-pound locomotive designed to haul 1,200-ton trains at 100 miles an hour was exhibited.

The addition of minute amounts of silver to stainless steel was found to improve its resistance to corrosion in salt water.

Air treatment for stainless steels during fabrication was shown to increase resistance to corrosion in sea water.

Commercial development was undertaken of frequency modulated radio transmission which is free from natural or man-made static.

The fulchronograph, a rotating magnetic lightning recording device, was developed, which successfully measured the maximum current of a direct lightning stroke and charted its complete wave shape.

By a new process of insulating telephone wires, the number of wires which can be placed in present size cables was increased by 606 to a total of 4,242 wires.

Current-carrying capacity was increased by filling underground electrical cables with gas.

A new type of cubic-shaped antenna was developed for the transmission of super-television programs.

Scheduled television programs, after many years of experimentation, were inaugurated.

Accurate values for the viscosity of steam up to pressures of 2,000 pounds and temperatures of 1,100 degrees Fahrenheit were found.

Shasta Dam, irrigation project in the Sacramento-San Joaquin valley, Calif. was begun.

The Federal government began the acquisition of strategic mineral stockpiles with a \$10,000,000 purchase fund.

Iron 99.99% pure was made to serve as a spectroscopic standard.

The cost of rural electrification was reduced from \$1,500 to \$500 a mile by the use of strong wires and an improved tie for the power poles.

Means of producing smoother surfaces for automobile moving parts promise greatly to reduce wear and to extend the useful life of autos.

Ultra-high frequency radio waves were used to dry pottery, requiring less than a third the time of present methods.

Routine, assembly-line testing of all large transformers with high voltage shocks of artificial lightning was inaugurated.

Models of bridges and buildings and mines were tested for strength by whirling in a large centrifuge.

A method of oil prospecting was developed which measures temperatures in the earth at depths of 100 to 300 feet.

The U. S. was without major mine disasters during 1938-39, the first such accident-free year recorded.

By heating low valued brown coal, lignite, and light petroleum oil in a closed vessel an improved fuel was created.

Lignin was found to be more efficient than any chemicals now used in removing iron from water.

Tiny gyroscopes were designed for use in steering rockets.

A vacuum tube which will give nearly 11½ years of continuous service was developed.

A new and improved method for extracting cottonseed oil was developed.

Electrical devices were developed which can synthesize human-like speech out of two sounds, a buzz and a hiss.

A method was developed for controlling the

feeding of a crusher mill by the sounds of the grinding operation.

For analyzing the smoothness of operation of industrial machines, stethoscopes were employed to give a running record of frequency analysis.

A synthetic reverberation machine was developed for use in radio broadcasting.

A thermal pump device that uses heat instead of mechanical energy to compress gases, create vacuum or transfer heat against its normal direction of flow was invented.

Thermoplastic resins were used for hemming textiles and fabrics.

Plasticized sulfur was used as a binder for brick roads, glass skylights and parts of washing machine tubs.

MATHEMATICS

Progress Was Continued in "Handmaid of Sciences"

A new generalization of the length of a curve made it possible to determine the "length" of very general sets of points in a plane.

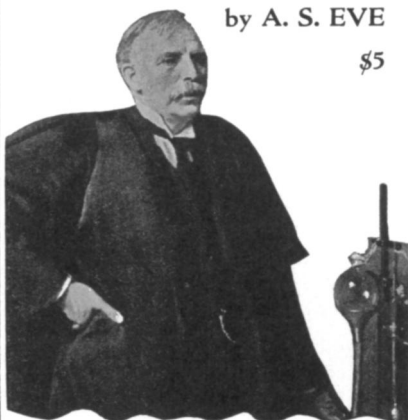
Properties of several important subsets of well known function spaces were studied.

Progress on the famous continuum problem, which concerns infinite numbers and whether there is any infinite number substantially smaller than the number of points on a line and substantially larger than the number of whole numbers, showed that there is no inconsistency in assuming that no such number exists, though it has not been proven that there is no such intermediate number.

The ergodic theorem was extended on the one hand to the study of homogeneous chaos;

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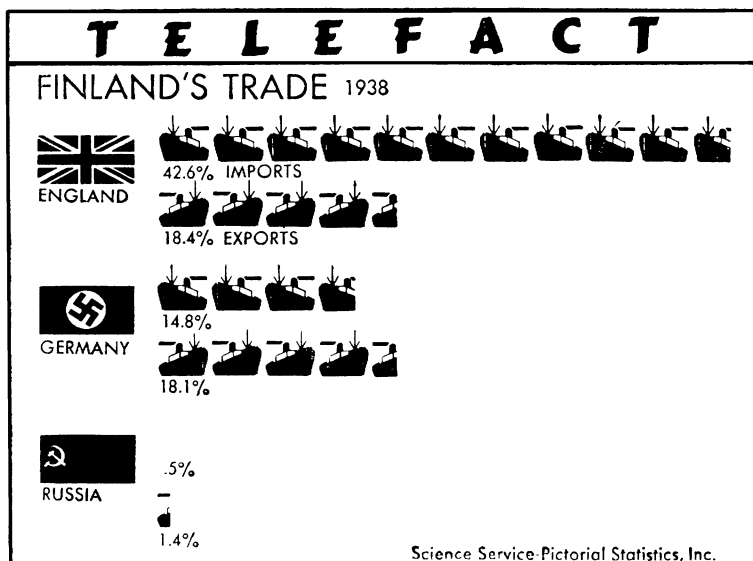


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on the other hand, to the problems of diffusion of gases, hydrodynamics, and statistical mechanics.

The mathematical theory of the change in temperatures occurring in a non-homogeneous bar with discontinuous initial temperatures was studied.

Properties of very general spaces were investigated by means of related configurations called gratings."

An application of elegant modern methods for elliptic functions and fields to the study of the more general abelian fields was outstanding in abstract algebra.

A reduction was made in the conditions required for inferring the regularity of a function of a complex variable in open sets of points.

A solution to the problem of fitting straight lines when both variables are subject to error was obtained under fairly general conditions without making any *a priori* assumptions regarding the relative magnitudes of the standard deviations of the two variables.

Unbiased tests of statistical hypotheses relating to parameters of location and parameters of scaling were advanced, a statistical test being termed unbiased if by its continued use the hypothesis tested will be rejected when it is true less often in the long run than when it is false and one of its admissible alternatives is true.

Mathematics was used in the development of dynamic economics and the study of economic systems based on hypotheses expressed in mathematical symbols.

Using thin straight lines of unlimited length, a new kind of drawing was developed, which, by following complex integral equations, produces shaded designs and picture effects.

Cinema Integraph, a calculation machine em-

ploying motion picture film and visible radiation, was developed for solution of engineering problems involving integration.

An international abstract journal, *Mathematical Reviews*, was established in America, to replace a similar German journal ruined by Nazi domination.

General differential geometry with abstract coordinates in infinitely many dimensions has been developed.

MEDICAL SCIENCES

Pneumonia Deaths Reduced By Use of Sulfapyridine

The pneumonia case fatality rate was materially cut in 1939 by use of the new chemical remedy, sulfapyridine, while this and the related chemicals, sulfanilamide sulfathiazole and sulfamethyethiazole, were reported promising in treatment of smallpox, primary peritonitis in infants, certain tropical diseases, infection with *Hemophilus influenzae* (not virus influenza), tularemia, trichinosis, otitis media, gonorrhoea, meningo-encephalitis of dogs, chronic ulcerative colitis and staphylococcus infections; not useful in tuberculosis; and an effective vital stain for plant and animal tissues.

The National Cancer Institute at Bethesda, Md., was completed and occupied by its cancer research staff.

New buildings for Memorial Hospital for the treatment of Cancer and Allied Diseases, in New York City, were completed.

A bill to extend medical and health services throughout the nation through a national health program was introduced into the Senate by Senator Robert F. Wagner, N. Y., and hearings were held and a preliminary report made, but the bill was not reported out of committee before Congress adjourned.

Refrigeration of human cancer patients to the point of artificial hibernation gave relief of intractable pain in more than 80 hopeless cases with regression of the tumor in some.

Cases of ulcerating X-ray and radium burns were cured with no recurrence during 10 years and probably prevented from becoming cancerous by treatment with alpha rays, beryllium and boron.

Discovery of significant changes in the body's electrical field which occur with the growth of body cells and appear to begin at the start of the extraordinary growth of cells which produce cancer promises aid in the attack on cancer and diseases of the nervous system.

Treatment of cancer by neutron rays from the cyclotron were started.

"Cocktails" of radioactive sodium phosphate proved at least as effective leukemia treatment as X-rays in preliminary human trials of what is hoped will prove a "cure" for this fatal disease.

Vitamin K has been obtained in crystalline form and its chemical constitution has been determined as probably 2-methyl-3-phytyl-1, 4-naphthoquinone. Similar naphthoquinone compounds made synthetically exert the same influence in promoting the formation of prothrombin, one of the necessary factors in blood coagulation. They have been used successfully in treating certain diseases in which bleeding occurs from lack of prothrombin, such as obstructive jaundice and the bleeding of new born infants.

Prevention of 50% of deafness in adults is the future accomplishment expected from the discoveries that hyperplastic lymphoid tissue in and around the orifice of the eustachian tubes during childhood is the cause of middle ear deafness, that the condition can be detected by nasopharyngoscopic examination and that it can be checked by radium treatment.

Important development in the fight against infantile paralysis was the successful transmission of the virus to the Eastern cotton rat, which for the first time gives another animal than man or monkey for investigations looking toward a cure or preventive of the disease.

"Hormone banks," new technic in endocrine therapy evolved by English scientists and consisting of burying several months' supply of hormone in pellets under the skin, was successfully used in cases of Addison's disease and hypogonadism in both males and females.

Adrenal glands from animals were implanted under the skin of Addison's disease sufferers with more or less improvement in mild cases and improvements lasting 5 to 6 months in severe cases.

Male sex hormones were found to be of utility in treatment of reproductive-system disorders in women.

Much progress was made in the synthesis, identification, and chemical manipulation of hormones.

Intensive studies were made in numerous clinics of utility and limitations of synthetic female sex hormones, stilboestrol.

Tanning from exposure to sunlight was shown to be importantly dependent upon sex hormone.

Noma, serious human mouth ailment, was produced for the first time in monkeys by a deficient diet in studies indicating that dietary deficiencies rather than germs may be responsible for other human mouth and tooth ailments such as trench mouth.

Discovery that earthworms are a reservoir of swine influenza virus was reported as giving a possible new lead for study of human influenza.

Cause of a new and fatal convulsive ailment of babies, encephalomyelitis, was identified as a toxoplasma.

Vaccine for protecting humans against horse "sleeping sickness" was developed.

A nation-wide drive to eradicate gonorrhoea, second "hush-hush" plague, was started by the U. S. Public Health Service.

The American Museum of Health, first institution of its kind in the United States, was established in New York City.

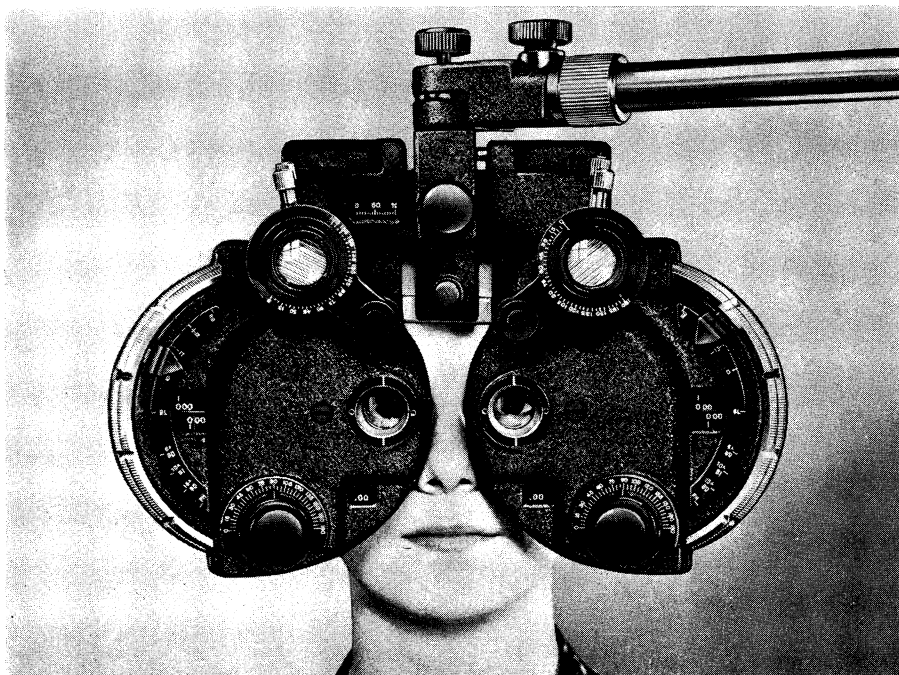
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Known as a Phoropter, this new eye-testing instrument contains only 36 lenses, but can determine for oculists any one of 61,060,386,816 prescriptions for glasses. Fitting persons for glasses used to be done by hand, inserting different lenses into frames. By manipulating the dials of this new device this tedious task can be done rapidly and accurately for it adds, automatically, the magnifying powers of its 36 lenses in various combinations.

Vitamins B and C were found useful remedies for retinal bleeding in diabetes.

Cultivation of rabies virus outside the brain of a living animal, once considered impossible, was accomplished and may make anti-rabies vaccine production easier.

Making glutathione radioactive, scientists found themselves better able to trace the course of this important chemical in the body, and to explain mechanism of its action.

New X-ray technic was developed for detecting placenta praevia by sixth month of pregnancy, thus allowing time to save both mother and baby from this often fatal complication.

Fluorine in drinking water, known to be the cause of mottled enamel of teeth, may act, according to some new observations, as a preventive of caries.

Inhalations of pure oxygen were found to give prompt relief from migraine headaches.

The common gray house mouse was discovered to be a carrier of the causative virus of the human nerve disease, choriomeningitis.

Control of hemorrhage in over 500 patients by doses of oxalic acid, usually considered an anti-coagulant, was reported.

A fatherless rabbit, developed in a foster mother's body from the non-inseminated ovum of a rabbit of another species that was activated by a salt solution in a test tube, was demonstrated, and similar activation of human ova was reported.

Riboflavin, one of the B vitamins, is necessary for human nutrition, it was discovered from investigation of cases of ariboflavinosis, condition formerly confused with pellagra.

Treatment with vitamin B₁ and liver extract was successfully used in over 50 cases of trigeminal neuralgia or tic douloureux.

Synthesis of the female sex hormone, equilenin, was announced.

Apparent cures of chronic lead poisoning in a score of cases by treatment with vitamin C were announced and liberal amounts of the vitamin in the diet were advised as preventive of the condition.

Isolation and crystallization of a horse liver enzyme, a catalase, important because it protects living cells from poisoning and destruction by the hydrogen peroxide they form, was announced.

Partial sex determination by diet was achieved in rats, high protein diet fed the male parents and low protein to the female parents resulting in a sex ratio of 145 males to 100 females in the offspring.

Injections of the chemical, xanthine, were found to prevent jaundice and other liver damage in animals, a discovery believed useful for combatting human liver damage from solvents used in industries such as dry cleaning, plastics and certain manufacturing processes.

Discovery that cobalt helps to restore red blood cells in benzol-caused anemia in animals may prove useful in combatting the anemia of benzol poisoning, an industrial hazard.

Cubicles for the isolation of babies in hospitals and homes, to prevent transfer of disease germs by cross-infection, were developed following the technic which is being used to produce germ-free guinea pigs for better scientific investigation of human diseases.

Anti-influenza vaccine was made by cultivation of influenza virus on chick embryo membranes.

Ascitic fluid was found to be an efficient substitute for blood in restorative transfusions after shock.

A simple new blood test for malaria, depend-

ing on chemistry, not bacteriology, with an accuracy of 97.4%, was reported.

Hearing tests of over 500,000 persons, greatest analysis of deafness among the population ever undertaken, revealed among other significant facts that eight out of every 1,000 has difficulty hearing direct conversation, hearing ability diminishes with increasing age and is particularly noticeable at the higher frequencies of sound.

Treatment with sulfapyridine and heparin was announced as promising hopeful results for sub-acute bacterial endocarditis.

Apparent cure of hitherto incurable and rare scleroderma by parenteral treatment with an acid preparation known as Aciform II was announced.

Failure of the anterior pituitary gland to produce enough of one of its hormones, prolactin, was said on theoretical grounds to be the cause of sprue.

Plummer-Vinson syndrome, curable and even preventable by dietary and iron treatment, was discovered to be a predisposing factor in development of cancer of mouth, pharynx and esophagus in women.

The grand jury indictment of the American Medical Association, the District of Columbia Medical Society and a number of individual physicians on charges of conspiracy in violation of the Sherman anti-trust law, was thrown out by Federal District Justice James M. Proctor on the ground that the Sherman act does not count medical practise as a trade, and the U. S. Supreme Court refused to review the case before it had been taken to the U. S. Circuit Court of Appeals.

PSYCHOLOGY AND PSYCHIATRY

Study Psychology of War; Find How Metrazol Works

Threat of European conflict and its reality stimulated research on the mental causes leading to war, effects of propaganda and war on the minds of belligerent and neutral peoples, and means of protection from its influence.

A plan for improving the world's population and making genius "every man's birthright" was framed by geneticists, involving birth control, conscious selection, medical care especially for mothers and improved economic and social conditions.

Dentists, artists, engineers and teachers, not clergymen, church members, lawyers or domestic servants, were found to be more numerous in the cities rating highest in "general goodness of life for good people."

Use of strychnine to vary the pattern of brain waves from the sensory cortex made possible the mapping of that area which was found to be

LANGUAGES

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very large with major subdivisions serving sensation in the face, arms and legs separately.

Idea of a strictly localized speech center in the brain came into further question when it was observed that some patients recover after loss of speech through brain injury.

Three color pigments were found in the cones of a chicken eye and identified as responsible for color vision, acting as color filters do in photography: astacene, xanthophyll, and carotene; a fourth violet light-sensitive pigment, was found in the color "film" on which the filtered light falls.

Color blindness was induced under hypnosis.

The drug curare was found to depress the brain cortex or that part of the higher nervous system between the cortex and the spine so that learning can take place only through sub-cortical parts of the nervous system, explaining ability of the drug to produce "dual personality."

Verbal conditioning takes place through the cortex, it was indicated by a demonstration that transfer conditioning is greater for words alike in meaning than for words alike in sound only.

Development of infants under one year old is not affected by the type of culture in which they live, it was observed.

Escape from fear is more powerful as an aid to learning than is punishment, animal experiments demonstrated.

Pre-linguistic symbolic ability was traced to its evolutionary beginnings in the chimpanzee.

Rats were found to develop a caste system of workers and "parasites" when food was obtainable only after a bar had been pushed at the opposite end of the cage from the feeding box.

Influence of reward and punishment was studied quantitatively by measuring the pulling strength of rats seeking to reach food or avoid punishment, and the development of "conflict" was observed when punishment awaited the animals in every direction.

A dominant chimpanzee, although intelligent, was found to have difficulty in learning from a submissive one, an observation with possible implications for human education.

A natural mating period for primates was found, coinciding with the fertile period in females, in observation of socially uninhibited chimpanzees.

Comparison of a selectively bred "emotional" strain of rats with another strain bred for non-emotional qualities revealed that the average weights of adrenal, thyroid and pituitary glands were greater for the emotional animals, suggesting that emotions are linked with endocrines and that size of glands is inherited.

Ability of airplane pilots and others to adapt visually to dim illumination at high altitudes was investigated, an instrument was devised to measure such adaptation, and glucose was found to improve it.

A special fund of more than \$100,000 was set aside from the U. S. Government's civilian pilot training program to develop new and better methods for selecting and training pilots.

Discovery that metrazol, used in shock treatments of the mental disease, schizophrenia, achieves its in-some-cases remedial effect by bringing about a "new deal of nerve endings" was announced on the basis of direct observations of the effects of metrazol on living nerves of frog tadpoles.

Nitrogen inhalations were used with some success in treatment of schizophrenia, the reported success being ascribed to decrease in the metabolic activity of the brain by oxygen deprivation without the violent shock of insulin or metrazol.

Brain wave study revealed that a chemical pacemaker controls the brain's activity through

cell respiration, promising new understanding of paresis, brain syphilis.

Blood tests revealed that cell respiration in the brain is heightened during the fever treatment for the mental disorder paresis, brain syphilis, throwing new light on how the treatment benefits.

The tissue of brain tumors is not electrically active, it was discovered when brain waves were taken directly from brains exposed during operation.

New accuracy was attained in the study of the mentally diseased through combining physiological measurements such as skin temperature with psychoanalytic techniques; it was revealed that emotions chill the fingertips even when the patient is not aware of being roused.

Discovery that alteration of personal psychodynamics correlates with shifts in cyclic hormone production in women opened up a new avenue of research in human personality.

A new rare hereditary form of imbecility, phenylpyruvic oligophrenia, was discovered and traced to failure of the body to metabolize phenylalanine, an amino acid necessary to growth.

A study of mental disorders in city areas indicated a link between the type of neighborhood and type of mental disease.

Plans were announced for eliminating psychopaths and potential victims of mental disease among recruits to the armed forces in the event of another war involving the United States.

Psychosomatic Medicine, a journal for studies of the human organism as a whole, from both physical and psychological aspects, started publication.

REWARDS AND RECOGNITIONS

Nobel Prizes for Cyclotron, Prontosil, Hormone Study

The 1939 Nobel Prize in Chemistry was awarded to Prof. Adolph Butenandt of Berlin and Prof. Leopold Ruzicka of Zurich, for isolation and synthesis of the male sex hormone testosterone, thus making it available for medical use.

The 1939 Nobel Prize in Physics was awarded to Prof. Ernest O. Lawrence of the University of California in recognition of his development of the cyclotron.

The 1939 Nobel Prize in Medicine and Physiology was awarded to Dr. Gerhard Domagk, of the I. G. Farbenindustrie, for his discovery of the life-saving chemical Prontosil; Dr. Domagk also received the Cameron Prize of Edinburgh University.

The 1938 Nobel Prize in Chemistry was awarded to Prof. Richard Kuhn, of the Kaiser Wilhelm Institute of Berlin for his research on carotinoids and vitamins.

Dr. William Bowie, of the U. S. Coast and Geodetic Survey became the first recipient of a medal newly established in his honor by the American Geophysical Union.

The Chandler Medal of Columbia University was awarded to Thomas H. Chilton, director of the technical division of the engineering department of E. I. du Pont de Nemours and Co., for his contributions to the principles on which chemical engineering is built.

Gano Dunn, president of the J. G. White Engineering Corporation and of Cooper Union was selected for the 1939 Hoover Medal for distinguished public service by a board representing four national engineering societies.

Dr. David Fairchild, dean of America's plant explorers, received the Meyer medal for plant introduction.

The John Fritz gold medal was awarded posthumously to Dr. C. F. Hirschfeld of the Detroit Edison Co.

The Collier Trophy was awarded to Howard Hughes for his round the world flight.

The 1940 Willard Gibbs medal of the American Chemical Society's Chicago Section was awarded to Dr. Vladimir N. Ipatieff, Universal Oil Products Co. chemical research director and formerly leading chemist in Russia before the Soviet regime.

Dr. Frank B. Jewett, head of Bell Telephone Laboratories, was elected president of the National Academy of Sciences.

The Daniel Giraud Elliot medal of the National Academy of Sciences was awarded to Prof. Richard Swann Lull, of the Peabody Museum of Natural History, Yale University, for his research on horned dinosaurs.

Discovery of a cause of nervous breakdowns, demonstrated by laboratory rats to be a forced decision when no alternative is right, won for Dr. Norman R. F. Maier, of the University of Michigan, the \$1,000 prize of the American Association for the Advancement of Science.

Prof. James W. McBain, Stanford University, was honored with the Davy Medal of the Royal Society of London.

The Royal Society of London awarded the Copley Medal to Prof. Thomas Hunt Morgan, of the California Institute of Technology.

The William H. Nichols medal of the American Chemical Society's New York Section was awarded to Dr. John M. Nelson of Columbia University.

The Daniel Giraud Elliot medal of the National Academy of Sciences was awarded to Prof. Theophilus S. Painter of the University of Texas for his contributions to the science of genetics.

The Lamme Medal of the American Institute of Electrical Engineers was awarded to Marion A. Savage of the General Electric Company for work on the development of large high speed turbines.

The Penrose Medal of the Geological Society of America was awarded to Prof. W. B. Scott, of Princeton in recognition of eminent research in pure geology and of outstanding original contributions or achievements which mark a decided advance in the science of geology.

The Hayden Memorial geological medal of the Philadelphia Academy of Natural Sciences was awarded to Sir Arthur Smith-Woodward.

The American Institute's Gold Medal was awarded to the Sperry Gyroscope Company of Brooklyn, N. Y., for the automatic pilot and other important air navigation instruments.

The Perkin medal of the Society for Chemical Industry was awarded to Dr. Charles M. A. Stine, du Pont's vice-president in charge of research.

The Agassiz medal for oceanography was presented by the National Academy of Sciences to Dr. Harald Ulrik Sverdrup, of the Scripps Institution of Oceanography.

Dr. Donald Dexter Van Slyke, of Rockefeller Institute Hospital, New York, was awarded the 1939 Willard Gibbs Medal of the Chicago Section of the American Chemical Society for research in physiological chemistry.

Treatment of Addison's disease patients by a new technic of burying under the skin an 8-months' supply of pills of synthetic adrenal cortex hormone crystals won for Drs. George W. Thorn, R. Palmer Howard, Kendall Emerson, Jr., and Warfield M. Firor, of Johns Hopkins Hospital and Medical School, the American Medical Association's gold medal for the best exhibit of original work.