

GENERAL SCIENCE

Science Strides Forward

Progress in 1934 Included Production of Artificial Radioactivity; Life-Saving Hormone Isolated

By SCIENCE SERVICE STAFF

OUTSTANDING 1934 achievements in ten fields of science as selected by Science Service are:

1. **Aeronautics**—The application of aerodynamic advances to practical aircraft as demonstrated in the London-Melbourne and other flights.

2. **Archaeology**—The discovery of more evidences of Folsom man in America, indicating the peopling of the western world at an early date.

3. **Astronomy**—The interstellar spectrum absorption lines indicating material existing between the stars, the photoelectric detection of extreme ultraviolet solar radiation, and the casting of glass disks and the selection of a site for the 200-inch telescope.

4. **Biology**—The method for accurately locating the "genes," or heredity-determining units, in their places on or in hitherto unexamined structural subdivisions of chromosomes.

5. **Chemistry**—The discovery of triple-weight hydrogen in pure chemistry and the extraction of bromine from sea water commercially.

6. **Engineering**—The development of high speed rail transportation and the launching of the gigantic steamship *Queen Mary*.

7. **Geology**—The new high estimate of the age of the earth, 1,725,000,000 years, established by Miss Edith Kroupa of the University of Vienna, using radioactive products in Canadian rock.

8. **Medicine**—The determination of the chemical formula for cortin, life-saving hormone of the adrenal gland cortex, and its preparation in pure crystalline form.

9. **Physics**—The production of artificial radioactivity by the Joliot's of Paris, giving promise of new atomic knowledge and new radiations for medicine and industry.

10. **Psychology**—Experimental evidence that learning known as the conditioned reflex is of two kinds, one of which can take place although the brain cortex is completely missing.

Among the many advances in science during 1934 were:

Aeronautics

Despite the accident in the ascension of the Army Air Corps-National Geographic Society's balloon the *Explorer* in its stratosphere flight, Capt. A. W. Stevens, Maj. William Kepner and Capt. Orvil Anderson brought back valuable information about the upper air including: temperature and barometric data from the ground to the 60,613-foot altitude reached; records of sky brightness at various heights; data on cosmic rays; in addition to contributing materially to the technique of handling large balloons.

Examination of the fabric of the ill-fated balloon *Explorer* used in the National Geographic-Army Air Corps stratosphere flights disclosed that the cause of the disaster rip could be attributed to the new way of folding part of the bag inside the envelope with accompanying sticking-together of the rubber-coated material.

Prof. and Mrs. Jean Piccard, stratosphere balloonists, reached altitude of 57,579 feet in an ascension which obtained valuable cosmic ray data for Prof. W. F. G. Swann of Bartol Research Foundation.

Two fully automatic variable pitch propellers, one a constant thrust propeller built by the Eclipse Aviation Corp., and the other a constant pitch propeller, announced by the Hamilton-Standard Propeller Co., will further increase efficiency and safety in flying.

Commendable performance by many wingless autogyros, such as those of Rohrbach, Strandgen, Platt and Chapedelaine, foretells increased use for this form of air transport.

Autogyros and gyroplanes, machines supported by a supplementary rotor from power derived from the motion of the propeller, will be superior to conventional aircraft as soon as their possibilities for high speed are developed, John B. Wheatley, National Advisory Committee for Aeronautics, predicted.

Because budget reduction forced the Bureau of Air Commerce to remove the 1,000-watt electric lights from airway beacons the National Bureau of Standards discovered ways to make 500-watt lamp beacons yield 25 per cent. more candle power than did the 1,000-watt bulbs.

Through a grant from the Guggenheim Foundation, Prof. Robert H. Goddard of Clark University continued his rocket researches at Roswell, N. M.

Construction neared completion on what will be the world's largest airship, the German LZ-129, expected to cross the Atlantic in from two to three days.

A new land speed record for a three-kilometer course was achieved by Warrant Officer Francesco Agello of Italy who reached a speed of 440.681 miles an hour.

Like the speed record for airplanes, the world's altitude record for aircraft was claimed by Italy in 1934 when Commander Renato Donati, on April 11, climbed to 47,352.219 feet, using oxygen-breathing equipment.

The trans-continental record for airplanes of transport type was reduced to 12 hours and 4 minutes in an Eastern Air Lines Douglas plane.

Nine world's records for seaplanes were established on the one test flight on a closed course over New York City and nearby Connecticut when Edwin Musick, Boris Sergievsky and Charles A. Lindbergh flew the Sikorsky "Brazilian Clipper" for an average speed of 157 miles an hour over a distance exceeding 1242 miles.

The world's distance record for seaplanes was increased to 2,399 miles by the flight of the Navy from California to Hawaii in a patrol plane containing Lieut.-Comdr Knefler McGinnis, Comdr. Marc A. Mitscher, Thomas P. Wilkinsin, Charles S. Bolka and Glen C. Eddy.

The world's glider record for distance was increased to 233.014 miles by Heinrich Dittmar of Germany after a takeoff from the famous glider field on the Wasserkuppe.

The American glider record for distance was increased to 158.299 miles by Richard C. duPont, in a flight from Elmira, N. Y., to Basking, N. J.

T. Campbell Black and C. W. A. Scott, British pilots flying a de Havilland Comet, won the England to Australia air race, covering the total of 11,325 miles in 71 hours flat. Two American stock transport planes, carrying heavy loads, won second and third place in this race—a remarkable tribute to our transport design.

Sir Charles Kingsford-Smith and his navigator, Capt. P. G. Taylor completed the 7,365 miles flight across the Pacific Ocean from Australia to California in the veteran plane *Lady Southern Cross*.

Trans-continental record for airplanes carrying air mail was reduced to 11 hours and 31 minutes by Jack Frye, vice-president of T. W. A., in a Northrup Gamma monoplane.

Pan-American Airways installed regular flying service throughout the Caribbean Sea to Central and South America with the "clipper" type of flying ships having such speed that Florida is less than four days flying time from Buenos Aires.

An acoustical altimeter, accurate to within four feet of altitude, was invented by Lieut. Leo P. Delsasso, U. S. Naval Reserve, also a physicist at University of California at Los Angeles.

Anthropology and Archaeology

In the cave which had yielded remains of Peking Man, China's oldest known inhabitant, bones and implements of *Homo sapiens* were found by Dr. W. C. Pei and M. N. Pien of the Chinese Geological Survey,

showing that China was in step with Europe in the latter part of the Old Stone Age.

A new and more important niche in human pre-history was assigned to Wadjak Man, by Prof. G. Pinkley, London University, who concluded from study of the teeth that Wadjak Man, previously considered a forerunner of Australia's natives, foreshadowed the Mediterranean type of man.

Solo Man, prehistoric race in Java 40,000 years or more ago, demonstrated by additional evidence—his stone and bone implements—that he was akin to his Neandertal contemporaries in Europe.

A dictionary of the Indian sign language, begun by the late Major General Hugh Scott, was completed for the Bureau of American Ethnology by Richard Sanderville, 70-year-old Blackfoot Indian.

Prof. A. E. Jenks, University of Minnesota, reported finding in Minnesota a human burial accompanied by stone dart points which he pronounced "Folsom and Yuma" types, thus for the first time bringing together an early American hunter and the stone-tipped weapons he used in slaying mammoths and other extinct animals.

The first discovery of a settlement site of America's most ancient known people, the hunters who made "Folsom type" weapons, was made in Colorado, and announced by Dr. Frank H. H. Roberts, Jr., Bureau of American Ethnology.

Salvaging of Indian ruins, and valuable historic data connected with them, was made possible at various sites where Federal funds were allotted for museums, CCC camps, or other agencies to conduct excavations.

Evidence of a brilliant civilization was discovered in Panama, when Dr. S. K. Lothrop, Peabody Museum of American Archaeology and Ethnology, Harvard, unearthed graves of chieftains decked in golden ornaments and surrounded by quantities of cultural objects.

The fortress of Sacsahuaman, wartime capital of the Incas, was unearthed by archaeologists of the Peruvian National Museum.

Pre-Incan Indian life on the shores of Lake Titicaca, Bolivia, 1,200 years ago was reconstructed by excavation of adobe and stone houses, with basement burials, by Dr. W. C. Bennett, American Museum of Natural History.

That the dawn age of man's emergence into cultural evolution lasted tens, possibly hundreds of thousands of years, was suggested by J. Reid Moir's announcement that he sorted crude "dawn" tools of England's Stone Age into four kinds belonging to geologic periods ending in the Pliocene.

Helpful evidence for reconstructing Ireland's pre-history was found by the Harvard archaeological expedition in Ireland, which made the first discovery there of relics of four Stone Age cultures in stratified position at one site.

A musical pipe made of a lion's tooth, found in the mountains in Czechoslovakia, was pronounced by Prof. Karel Absolon, Brno University, the oldest musical instrument known in the world.

Discovery of inscriptions and public buildings at ruins believed to be Olynthos, in Macedonia, confirmed this site as Olynthos, Dr. David Robinson, Johns Hopkins University, reported.

Excavations at the Athenian Agora, directed by Prof. T. L. Shear, Princeton University, yielded ruins of the city's most famous altar dedicated to the Twelve Gods,

and the circular Tholos, a valuable landmark for tracing the plan of the ancient city.

Workmen repairing the Church of St. John Lateran, Rome, came upon walls of the first seat of the Popes, 319 A.D., and also ruins of a first-century Roman residence.

Ruins of Nessa, capital of the ancient Parthian archers, were located near Aschabad in the Turcoman Soviet Republic, by Russian archaeologists, and the palace, chief temple, and other remains investigated.

The long-sought cemetery of Troy, belonging to the city of the Trojan War period, was found by the University of Cincinnati expedition, led by Prof. Carl W. Blegen.

The fortress of King Saul at Gibeah, his walled capital, was identified at Tell el-Ful, in excavations by Prof. W. F. Albright, director of the American School of Oriental Research at Jerusalem.

The American Schools of Oriental Research began excavation at the Bible town Bethel, as a memorial to the late Prof. M. G. Kyle who made outstanding contributions to archaeology of Bible times.

Excavation of Rayy, famous walled city in Persia, was begun by a joint expedition of the Boston Museum of Fine Arts and the University of Pennsylvania Museum, and early discoveries included ruins and relics from almost every age of Persian history to the thirteenth century.

At the foot of the Elbrus Mountains of Persia, Dr. Ture Arne of Sweden found remains of a Copper Age town of 2000 B.C. which may serve to identify the cradle region of Indo-European peoples.

A temple of the Persian deity Mithras, "strongest rival of Christ in the third cen-

tury A.D.," was discovered at Dura Europos by archaeologists of Yale and the French Academy.

With the finding of a cemetery of 200 graves older than 3000 B.C., the joint expedition of the British Museum and the University of Pennsylvania Museum ended its 12 year program at Ur of the Chaldees.

At Tell el-Amarna, capital of Pharaoh Akhnaton, the Egypt Exploration Society discovered striking evidence of the haste with which the city was built, and traced foundations of the roofless temple where the Pharaoh worshipped the Sun-Disk.

The Metropolitan Museum of Art completed its work at Lisht, Egypt, after 14 seasons, the new discoveries including an entrance chapel to a royal pyramid, showing for the first time what the architecture of these chapels was like.

Astronomy

Previously accepted dimensions of the Large Magellanic Cloud, nearest of external galaxies, were doubled (not less than 20,000 light years diameter) by studies under Dr. Harlow Shapley, Harvard Observatory.

The Milky Way galaxy in which we dwell (about 30,000 light years to its center) is no larger than other galaxies seen as spiral nebulae, Dr. J. S. Plaskett and Dr. J. A. Pearce, Dominion Astrophysical Observatory, Victoria, concluded from a study of the gravitational behavior of the so-called Class B stars.

The Milky Way galaxy was found to be only half as large as heretofore supposed



TAKING PUNISHMENT

This is what actually happens in that fraction of a second when the football player's toe meets the pigskin for the perfect placement kick. This high speed electrical flash photograph, taken at an exposure speed of 1/100,000th of a second by Prof. Harold E. Edgerton of the Massachusetts Institute of Technology, reveals for the first time what the eye has never seen. The kicker, Wesley E. Fesler, former all-American end at Ohio State University and now kicking and end coach at Harvard College used a ball inflated to the full playing pressure of approximately 13 pounds to the square inch. Measurement show that his foot penetrated at least half the diameter of the ball. Note the dust just to the left of the ball suspended in mid-air. The wires visible to the right of the pigskin were used to make the contact for the flash exposure.

through photoelectric measurements by Drs. Joel K. Stebbins and C. M. Huffer, University of Wisconsin, which verified the existence of dust particles in our galaxy that cause astronomers to misjudge true star distances.

The Milky Way galaxy in which the sun and earth are located may be nearly spherical instead of being watch-shaped as previously supposed, Dr. Harlow Shapley of Harvard College Observatory reported as the result of Harvard measurements of the cluster type Cepheid variables at large angular distances from the Milky Way.

A photoelectric cell device attached to the 100-inch Mt. Wilson Observatory telescope by Drs. Joel Stebbins and Albert E. Whitford showed the Andromeda nebula to be double its hitherto recognized size due to material on its edges detected by the photoelectric cell but "dark" to human eyes; photographs made with Harvard's Oak Ridge patrol telescopes extend the bounds of the nebula still farther, and bring out evidence that the system is nearly spherical rather than highly flattened.

A vast super-galaxy in the constellation of Hercules was discovered by Dr. E. F. Carpenter of University of Arizona's Steward Observatory, this "galactic archipelago" being perhaps 1,500,000 light years in diameter.

Great winds (4 to 40 miles per second) blow in the atmosphere of stars, Dr. Otto Struve and Dr. C. T. Elvey, Yerkes Observatory, determined from the evidence of spectroscopic phenomena which have puzzled astronomers for years.

Aluminum-coated glass reflecting telescopic mirrors were used by Prof. S. L. Boothroyd and associates of Cornell, working at Lowell Observatory, to photograph starlight in the extreme ultraviolet, with the object of obtaining information about temperatures and classifications of stars.

Argon was discovered in the atmosphere of distant stars by Dr. W. W. Morgan of Yerkes Observatory.

Zeta Aurigae, a naked eye visible star consisting of a very hot blue star that three times each eight years is eclipsed for a month by a cooler, gigantic reddish companion, was observed intensively in October because of the possibility of determining the composition, pressure and distribution of the outer atmosphere of the red star by the changes in the blue star's light shining through it.

Some wholly unexplained absorption lines, probably of instellar origin, in the spectra of stars were found by Dr. Paul W. Merrill of Mt. Wilson Observatory.

The peculiar intensities of oxygen lines furnished a clue to their mode of excitation in nebulae when Dr. I. S. Bowen of California Institute of Technology showed that oxygen is probably excited by residual radiation formed in the ionization of helium and that nitrogen in turn is excited by radiation that is a by-product of the oxygen excitation.

Quadruply ionized neon and triply ionized argon are responsible for certain of the emission lines of gaseous nebulae, according to the work of Dr. I. S. Bowen of California Institute of Technology, Dr. J. C. Boyce of Massachusetts Institute of Technology, Dr. Donald H. Menzel and Dr. Cecilia H. Payne of Harvard, Swings of Liege, and Edlen of Upsala.

Seventeen hundred hitherto unreported variable stars, 1,000 in the Small Magellanic Cloud and 700 in our own Milky Way, were found during Harvard researches.

The average temperature of the interior of the sun is 12,000,000 degrees Centigrade and the maximum is 21,000,000 degrees, Sir Arthur Eddington computed theoretically.

Motion pictures of a 25,000 mile "bomb" shot out from a sunspot were made by Robert R. McMath and R. M. Petrie at University of Michigan's McMath-Hulbert Observatory by means of the spectroheliocinematograph.

The sun's counter-glow or "Gegenschein" consists of two parts, an inner glow due to a dust ring inside the earth's orbit, and an outer glow due to dust ring outside the orbit of Mars, Dr. Cuno Hoffmeister of Babelsberg proposed.

Phosphorus, 59th of the 92 elements to be found in the sun, was identified by Dr. Charlotte E. Moore of Princeton, using solar spectrograms made by Dr. Harold D. Babcock of Mt. Wilson Observatory and phosphorus spectra by Dr. C. C. Keiss, U. S. Bureau of Standards.

A faint diffuse emission line agreeing in position with the great coronal line was found by Harold D. and Horace W. Babcock of Mount Wilson Observatory, in spectra of the solar chromosphere taken without an eclipse; the red coronal line was feebly present in absorption, and they found, in the far infrared, an absorption line of helium and possibly one of ionized helium.

Extreme ultraviolet solar radiation that leaks through the terrestrial atmosphere between the absorption bands of ozone and those of normal molecular oxygen was detected with sensitive photoelectric equipment by Edgar Meyer, Marcel Schein, and B. Stoll of the University of Zurich, observing from Switzerland's Jungfraujoch.

The total solar eclipse of Feb. 14-13, 1934, the paradox eclipse that ended the day before it began because it crossed the international date line, was observed successfully by Japanese and American astronomers from Losap Island in the Pacific.

A change in the magnetic field of the earth during the February total solar eclipse was detected by Commander Akiyosi of the Japanese Naval Hydrographic Office.

Hidalgo, asteroid that moves like a comet, was rediscovered in October at Simeis Observatory, Russia.

Comets or other objects sighted included: Reinmuth's comet of 1928 rediscovered by Dr. H. M. Jeffers of Lick Observatory, Encke's comet also picked up by Dr. Jeffers, an unusual object sighted by L. Boyer from Algiers University Observatory, Schwassman-Wachmann's Second Comet rediscovered.

Failure of a brilliant November meteor display made astronomers suggest the earth has lost touch with the densest part of the Leonid meteor swarm.

Unusual meteoric fireballs flashed over New England on Sept. 26 and over Maryland, Pennsylvania, and New Jersey on Oct. 17.

Pluto, farthest planet discovered in 1930, is about the size of the moon, Dr. Walter Baade of Mt. Wilson Observatory determined.

Two white spots on the planet Jupiter were discovered in April, one by a Berlin amateur and another by Prof. J. J. Nassau of Warner and Swasey Observatory in Cleveland.

The great red spot on Jupiter is a great island of frozen ammonia flowing on a sea of liquid hydrocarbons, like ethane, ethylene and acetylene, according to a postulate of

Dr. Arthur Adel of the University of Michigan and Dr. V. M. Slipher of Lowell University.

Jupiter and Saturn have atmospheres consisting largely of the deadly gases, methane and ammonia, researches by Dr. V. M. Slipher of Lowell Observatory, Dr. Arthur Adel of University of Michigan, Dr. Rupert Wildt of Goettingen, Dr. Theodore Dunham, Jr. of Mt. Wilson Observatory, showed.

Life on Venus was pronounced unlikely when Mt. Wilson Observatory studies by Dr. Walter S. Adams showed absence of oxygen or water above its dense surface-hiding clouds.

Venus has 10,000 times as much carbon dioxide as the earth, Dr. Arthur Adel of the University of Michigan concluded from a comparison of planet and laboratory absorption bands.

Comets and meteors can be shown with the Zeiss planetarium through use of a new device.

A television-photoelectric scanning of the uneclipsed sun will reveal the corona without waiting for total solar eclipse, O. M. Skellett of the Bell Telephone Laboratories suggested.

Aluminum came into use as telescope mirror coating, Dr. John Strong of California Institute of Technology so treating Lick's Crossley reflector and making preparations for aluminating the Mt. Wilson 100-inch mirror.

Scratch-proof telescope mirror coatings were made by Robley C. Williams of Cornell by evaporating a layer of chromium and then a reflecting layer of aluminum on the glass.

The 200-inch telescope progressed as follows:

Two 200-inch glass disks were poured at Corning, N. Y., for the main mirror.

Grinding of the 120-inch flat for testing the 200-inch began at Pasadena, Calif.

Palomar Mountain, northeastward 45 miles from San Diego, elevation 6,126 feet, was selected as the site.

An 85-inch glass disk for the University of Michigan Base Lake telescope and an 82-inch disk for Texas' McDonald Observatory were poured at Corning, N. Y.

The new 40-inch U. S. Naval Observatory telescope made by George W. Ritchey went into service.

A new wide-angle photographic telescope was planned for Lick Observatory.

The invention of the Schmidt telescope allowed the use of a spherical mirror with a slightly figured flat correcting plate instead of paraboloid, which is more difficult to make.

Biology

Genes, units of heredity, were accurately located on disk-like subdivisions of chromosomes by Prof. T. S. Painter, University of Texas, whose discovery was confirmed and extended by Dr. Calvin B. Bridges, Carnegie Institution of Washington, by Dr. Nikolai Koltzoff, Institute of Experimental Biology in Moscow, and by Dr. H. J. Muller, University of Texas, working with Dr. A. A. Prokofyeva at the Soviet Academy of Sciences in Leningrad.

Water columns in the sap vessels of plants can withstand tensions as great as 900 atmospheres, it was shown by calculations made at the University of Chicago by Drs. Clyde Homan, T. F. Young and C. A. Shull.

Sap rises in plants not as liquid columns filling the entire cavities of the conducting vessels but as films clinging to their walls, with water vapor filling the cavities, Prof. George J. Peirce, Stanford University, declared.

Detached root tips continued growth indefinitely in an artificial culture medium at the Rockefeller Institute for Medical Research, New York City, under the care of Dr. P. R. White.

A drought of unprecedented severity caused great losses to American agriculture and stock-raising, and also brought about a notable increase in the number of forest fires.

A new and highly menacing outbreak of the Dutch elm disease occurred in the region around New York harbor.

Chinch bugs and grasshoppers caused great damage to grain crops in the Western drought area.

Fungi in their wooden food appear to be necessary to termites, Dr. Esther C. Hendee, University of California, discovered.

A far-reaching program of game restoration through the purchase of submarginal lands and their management for game production was worked out by a committee appointed by Secretary of Agriculture Wallace.

Rabbit ova, fertilized outside the mother's body with sperm from a male, then implanted into a second female rabbit, developed as normal embryos and were born normally, in two experiments performed at Harvard by Prof. Gregory Pincus and E. V. Enzmann.

Turtles' hearts, frozen in liquid air, resumed beating, in the laboratory of E. A. Wolfe and R. A. Torgeson at the University of Pittsburgh.

Carotene, yellow coloring matter in plants that is the raw material for vitamin A, was discovered to be abundant in bacteria, by M. A. Ingraham and C. A. Baumann of the University of Wisconsin.

Chemistry

Triple weight hydrogen, three times as heavy per atom as the ordinary kind, was discovered at Cambridge's Cavendish Laboratory by Lord Rutherford, and Drs. M. L. Oliphant and P. Harteck; at Carnegie Institution's Department of Terrestrial Magnetism by Dr. M. A. Tuve, L. R. Hafstad and Odd Dahl; at Princeton University by Drs. Gaylord P. Harnwell, Henry D. Smyth, Walker Bleakney and Philip T. Smith.

Existence of helium of atomic mass three instead of four was reported by Dr. P. I. Dee of Cavendish Laboratory of Cambridge University.

Age-long impact of cosmic rays on the earth's surface caused the formation of the rocklike material of the crust out of the nickel-iron core, is the suggestion of Prof. Gilbert N. Lewis of the University of California.

A new chemical indicator called "nitrazine yellow" for telling the difference between acid and base solutions at low concentrations was developed by Dr. Henry Wenker.

Protactinium, after uranium the heaviest of all elements in atomic weight, was successfully isolated independently in the United States by Dr. Aristid Von Grosse, University of Chicago, and in Berlin by Drs. Georg Graue and Hans Kading, Kaiser Wilhelm Institute.

The atomic weight of protactinium was



FREAK FOWL

Nearly, though not quite wingless, and thus unlike the famous Plymouth Rock rooster from Kentucky now the subject of scientific experiments at Princeton (S.N. L., Oct. 13, 1934, page 234) the strange bird shown here adds abnormal body posture to his other peculiarities. Unlike the wingless rooster also in his choice of careers, he has taken to the road-show circuit instead of the quiet of scholarly cloisters. His owner, a former East St. Louis, Ill., man, is exhibiting his pet as a side-show freak.

measured as 231 times that of hydrogen by Dr. Aristid Von Grosse and M. S. Agruss of the University of Chicago.

Prof. Enrico Fermi, Italian physicist, reported the production of new material by bombarding uranium, present heavy-weight champion, with neutrons, but later found that what he had mistaken for element No. 93, was really a new form of actinium of atomic number 91.

Propane, a normal constituent of liquefied natural gas, can extract a considerable portion of the so-called Pennsylvania type of ingredient of lubricating oil, making a superior oil out of supposedly inferior western oils, Dr. Ulric B. Bray of Los Angeles found.

Specially prepared calcium sulfate or gypsum, called soluble anhydrite, was developed as a drying agent by Prof. W. A. Hammond, of Antioch College, and Prof. J. R. Winthrow of Ohio State University, useful in dehydrating alcohol and other chemicals.

Isolation in pure crystalline form of a new, very reactive substance, gamma methyl fructose, from fructose, the sugar of fruits, by Dr. Claude S. Hudson, U. S. National Institute of Health, called in question current chemical views as to the composition of sucrose, the common sugar of commerce.

Citric acid, which makes lemons sour, was extracted commercially from the cheapest kinds of Russian tobacco by Soviet chemists.

A rival for transparent cellulose wrapping material called Pliofilm was made synthetically from rubber which is moisture-proof,

elastic and easily sealed by slight heat and pressure.

A new antiseptic, azochloramid, soluble in water and not easily destroyed by heat, was reported to the American Chemical Society by Dr. Franz C. Schmelkes and Henry C. Marks.

Commercial extraction of bromine from sea water was achieved at the Wilmington, N. C., plant of the Dow Chemical Co., by a method which may have also, as a by-product, the extraction of gold from the water.

Various chemicals which stepped out of the "rarity" class into commercial production by carload lots during 1934 include: 1. Acetamide, valuable chemical solvent; 2. Diphenyl oxide, a fluid with high boiling point and chemical stability useful as a heat transfer agent between boiler furnace and high pressure steam in high temperature boilers, which allows cheaper boiler construction; 3. Boron carbide, industrial abrasive approaching the diamond in hardness, which is made from coke and boron in electric furnaces.

A new method of chemical separation of artificial radioactive isotopes from the parent substance was developed by Drs. Leo Szilard and T. A. Chalmers of St. Bartholomew's Hospital, London, which, for the case of iodine, involves the use of pure iodine vapor to prevent radioactive iodine atoms, formed by the bombardment of ethyle iodide, from returning to the target. The method appears useful for the concentration of man-made radioactive products of atomic numbers higher than 30.

Engineering

The giant Cunard-White Star liner, the 543, 1018 feet long and with expected speed of 33 knots, was launched and christened the "Queen Mary" by Queen Mary herself.

New record for North Atlantic crossing by steamship was made on Nov. 5 to 9 by the North German Lloyd liner Bremen, which went from Cherbourg to Ambrose Light off New York in 4 days, 14 hours and 27 minutes.

A new type of direction finder for ships incorporating a cathode ray oscillograph was devised by L. H. Bainbridge Bell and the British Government Radio Research Station.

Streamlined, high-speed trains planned and started in 1933 were completed and a record was made by the Union Pacific's M-10001 in a trans-continental journey from Los Angeles to New York City in 56 hours and 55 minutes.

While the new streamlined trains were breaking speed records throughout the country the regular steam train of the Chicago, Milwaukee, St. Paul and Pacific Railroad streaked between Chicago and Milwaukee at the average speed of 90.6 miles an hour for the 69 miles, attaining top speeds of 103 miles an hour.

Construction was begun on a new tunnel beneath Hudson River in New York City off West 39th street which will duplicate present Holland tunnel through which more than 75,000,000 vehicles have passed.

Queensway, largest and longest vehicular tunnel in the world, was opened between Liverpool and Birkenhead in England.

New railroad tunnels include: eleven and a third mile long Apennine tunnel of the Italian State Railways, and the Moffat tunnel of the Great Northern Railroad across the Continental Divide, (Turn to Page 394)

From Page 391

putting Denver, Colorado, on a main trans-continental line.

All-time construction record for pouring concrete was established at Boulder Dam when 10,462 yards of "liquid stone" was placed in one day.

Six new bridges of major importance were under construction in the United States, including Golden Gate and Oakland bridges both at San Francisco; bridge across the Mississippi River at New Orleans; Astoria bridge on the Columbia River; the bridge across Narragansett Bay and Tri-Borough Bridge, Manhattan.

World's largest camera, 31 feet long and weighing 14 tons, was placed in operation by the U. S. Coast and Geodetic Survey for copying nautical and aeronautical charts.

The shoal water fathometer, an improved "echometer," which will measure ocean depths less than 120 feet with an accuracy within one inch, was developed by the U. S. Coast and Geodetic Survey.

By use of short wave radio telephone the United States and Japan were linked in direct voice communication between any telephones in either country.

Radio waves of half-inch length, shortest produced by radio tubes up to that time, were used by Drs. C. E. Cleeton and N. H. Williams of University of Michigan to measure the ammonia molecule.

Marchese Guglielmo Marconi, "father of wireless," invented a new type of radio beacon, using microradio waves only a few centimeters in length, for the navigation of fog-bound harbors.

A system of radio facsimile transmission of photographs which uses a stylus and carbon paper to receive and record the wireless-sent picture, in a few minutes instead of an hour, was developed by engineers of the R. C. A. Victor Co.

A stringless piano, producing tones by electrical vibration and amplification of short steel slivers, was produced commercially.

Electric incandescent lamps, containing two filaments, which may be used either singly or in combination, were made available commercially.

An improved highspeed flashing 1,000 watt light for use in searchlight signalling contains hydrogen, and makes it possible to send dot and dash messages twice as rapidly with half the number of errors.

A new stress recorder apparatus for use on engineering models subjected to artificial earthquakes was developed by A. C. Ruge of the Massachusetts Institute of Technology.

An electrical apparatus that has persistence of vision, is sensitive to ultraviolet and infrared radiation and allows electrical magnification of an image was developed by Dr. V. K. Zworykin, R.C.A.-Victor Co. engineer.

Georges Claude, French inventor, sailed for the Brazilian coast with a ship adapted for ice-making which gets its power by utilizing the difference in temperature of the surface and bottom water in tropical oceans.

All-metal radio tubes, rugged and durable, were commercially available for the first time in 1934.

"Peanut" tubes, hardly larger than a shoe button, opened new possibilities for the development of pocket radio sets for broadcast listeners.

Short range, short wave radio receivers by which laymen can converse over a distance of 12 miles were made available.

Facsimile transmission of pictures, text and engraving by radio and wires reached commercial realization in newspaper offices.

A coaxial conductor, or concentric circuit, has been developed by Bell Telephone Laboratories which will transmit a band of frequencies one or two million cycles wide and can provide either for the multi-channel transmission of about 200 telephone messages or for wire transmission of television.

Method for dissipating fog demonstrated at South Dartmouth, Mass., by H. G. Houghton of research staff of Massachusetts Institute of Technology.

The \$100,000,000 Hetch Hetchy aqueduct supplying San Francisco with water was dedicated.

The world's largest ship elevator, taking vessels of 1,000 tons, was completed at Neiderfinow in Germany on the canal linking Berlin with the Baltic Sea.

The tremendous increase in gold mining during 1934 led to the introduction of the flotation method in treating gold bearing ores.

Deepest oil well in the world was drilled in California, reaching a depth of 11,000 feet.

Construction was begun on the Fort Peck Dam on the upper Missouri River. Its 100,000,000 cubic yards of earth will make it the largest dam of its type when finished.

Dr. Charles H. Herty and Morris R. Poucher developed a process for making rayon from Southern slash pine based on their previous work in making newsprint from the same source.

Increased adoption of dielectric engines for power in high-speed light weight trains occurred within the year 1934.

A special camera was developed which makes it possible to take detail pictures showing the characteristics of lightning and thus show the method of formation of the stroke, the rate of propagation and the number of multiple strokes in a single lightning flash.

A 400,000 volt X-ray tube was developed which is not dependent on a vacuum pumping system for operation. This raises by 100,000 volts the range of industrial radiography where vacuum systems cannot be tolerated as a part of the X-ray equipment.

Geology and Geography

A new high estimate of the earth's age, 1,725,000,000 years, was made by Miss Edith Kroupa of the University of Vienna, as the result of microchemical analysis of radioactive rock from near Winnipeg, Canada.

Important paleontological finds included two great mass deposits of fossils, one of dinosaurs near Billings, Mont., the other in a German lignite mine, both probably the records of wholesale death in long-past droughts; a "quarry" of horse fossils near Hagerman, Idaho; large numbers of extinct pigs in South Dakota; a nearly complete marine dinosaur near Whitewood, S. D.; Fossils of a small horse and a giant mammoth near San Diego, Calif., and the fossil bones of an eagle, in Wyoming.

Two fossil skulls, almost midway between reptiles and mammals, now in the Bloemfontein Museum, S. A., were pronounced one of the most important of all known evolutionary links, by Dr. D. M. S. Watson, University of London.

Two woolly mammoths, complete with hair and flesh, were found in the age-long frozen soil of northern Russia.

A record for deep-sea diving was established on Aug. 15 when Dr. William Beebe and Otis Barton reached a depth of 3028 feet in the bathysphere in the waters off Bermuda.

Abyssal submarine canyons off the coast of California were investigated by Prof. Francis P. Shepard, University of Illinois, collaborating with the U. S. Coast and Geodetic Survey and several California institutions.

A tremendous canyon, like that of the Colorado, was found in an inaccessible part of Mexico, by a California Institute of Technology expedition under R. T. Moore.

Calculations based on the effects of high-velocity bullets support the theory that Meteor Crater and similar great pits were caused by the instantaneous evaporation of impacting meteorites, Prof. C. C. Wylie, University of Iowa, announced.

Halemaumau Pit, in Kilauea volcano, broke into a spectacular eruption on Sept. 6.

The city of Tiberias, on the Sea of Galilee, was devastated by a storm and flood on May 14.

Samples of air taken in the stratosphere flight in the U. S. S. R. showed that its composition at great heights is approximately the same as at ground level.

The research ship "Atlantis" conducted a scientific survey of the fabled Sargasso Sea.

An international geographical congress, under the presidency of Dr. Isaiah Bowman, American geographer, was held in Warsaw, Aug. 23 to 31.

The first report of a Land Use Committee, of the Science Advisory Board, who are making a comprehensive scientific study of the country's natural resources, was presented to President Roosevelt on Dec. 1.

Checking the alarming progress of erosion of the Nation's best farm, range and forest lands was undertaken as a leading part in the program of public works.

The U. S. Weather Bureau is extending, with the cooperation of the Army and the Navy, systematic daily high-altitude airplane flights to obtain upper-air meteorological data, to use in the air-mass analysis of current weather.

Geologic effects of the great drought included a dust storm that covered half the country in mid-May, notable low levels in rivers and lakes, and diminished activity in many of Yellowstone Park's geysers and hot springs.

There were hundreds of icebergs in the North Atlantic during the spring but none of them got as far south as the main steamer lanes.

VITALISM and MECHANISM A DISCUSSION

between
HERBERT V. NEAL
Professor of Zoology, Tufts College
and
JAMES F. PORTER

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Two masses of rock fell off the face of Niagara.

Only three major tropical storms occurred in West Indian waters, but typhoons in the East Indian region were numerous, and several of them highly destructive.

There were 37 earthquakes of sufficient intensity to affect far-distant seismographs, several of them destructive to life, as in India on Jan. 15, in Afghanistan on June 14, and in Honduras on Dec. 2; in Utah a strong quake tore open the earth and produced fountains of brine.

The Soviet Government energetically pushed its program of arctic exploration.

Severe floods occurred in Poland during July.

An expedition under the leadership of Martin Lindsay crossed from Jakobshavn on the west coast of Greenland to the vicinity of Scoresby Sound and thence south to Angmagssalik, on what was the real objective of the trip—the exploration of 350 miles of the hinterland of the East Greenland coast.

The city of Nome, Alaska, was destroyed by fire on September 17.

On Nov. 16 a new building of the Scott Polar Research Institute was formally opened in Cambridge, England.

A deed of transfer of the territory of the disputed town of Leticia to Colombia by the commission appointed by the League of Nations was signed on June 19.

A new railroad line connecting Brazzaville on the Congo with Pointe-Noire on the seacoast of French Equatorial Africa was opened during the summer.

A section of the frontier between Libya and the Sudan, not previously demarcated, was defined in an agreement between the British and Italian governments.

Medicine

A triumph of obstetric and pediatric practice was the successful delivery and rearing, with every prospect after six months of continued life and health, of the Dionne quintuplets; credit for this medical triumph belongs to Dr. A. R. Dafoe, Canadian "country doctor," who struggled against great odds to save the mother and all five baby girls.

Progress in the fight against infantile paralysis was marked by reports of successful use in humans of two vaccines against the disease, one developed by Dr. Maurice Brodie of the New York City Health Department and the other by Dr. John A. Kolmer, Temple University Medical School, Philadelphia.

An anti-influenza horse serum, successful in mice, and a method of using these common laboratory animals for influenza studies were reported by Drs. C. H. Andrewes, P. P. Laidlaw and Wilson Smith, National Institute for Medical Research, London.

A method of protecting against encephalitis, popularly called "sleeping sickness," but so far applied only to mice, was developed by Drs. Leslie T. Webster and George L. Fite, Rockefeller Institute for Medical Research.

Vaccination against parrot fever or psittacosis was announced by Dr. Thomas M. Rivers, Rockefeller Institute for Medical Research; seven laboratory workers were first to be given this protection which is not considered practicable as yet for the general population.



FIRST OF THE FIFTY-SEVEN

Early in 1935 fifty-seven electric locomotives like this one will go into service in an all-electrified New York City to Washington run, linking the two cities in four hours or less. Most powerful electric passenger locomotives in the world, each will weigh 460,000 pounds, haul full-size, full-length trains at 90 miles an hour.

Isolation and preparation of the pure substance made by the tubercle bacillus that is responsible for the tuberculin skin test in man and animals was announced by Dr. Florence Seibert, Henry Phipps Institute, Philadelphia.

A new explanation of the cause of glandular diseases, such as exophthalmic goiter, which suggests revision in the method of treating these diseases, arose from the discovery by Dr. J. B. Collip and associates at McGill University that the body develops resistance to certain hormones after prolonged administration, probably because of the presence of antihormones.

Tremendous precocity of growth and development in successive generations of rats as a result of treatment with thymus gland extract and dwarfism in rats as a result of treatment with pineal gland extract, showing that normal stature apparently depends on proper balance between thymus and pineal glands, was obtained by Drs. Leonard G. Rowntree and J. H. Clark of the Philadelphia Institute for Medical Research and Dr. A. M. Hanson, Faribault, Minn.

Cortin, life-saving hormone of the adrenal gland cortex, was obtained in pure crystalline form for the first time and its chemical formula discovered, Dr. E. C. Kendall, Mayo Foundation, announced.

Sterility was cured in a significant proportion of human beings by giving to one or other parent an endocrine gland preparation to make up for hormone deficit, the late Dr. Allan Winter Rowe, Evans Memorial Hospital, Boston, reported.

The molecular weight and composition of the substance in the thyroid gland, the absence of which causes goiter, was determined by Dr. Michael Heidelberger, Columbia University, New York City.

In the posterior pituitary gland a new factor, probably a new hormone, which controls the activity of the acid-secreting cells of the stomach and may therefore be of in-

terest in connection with the production of stomach ulcers, was discovered by Drs. E. C. Dodds, R. L. Nole and E. R. Smith, Courtauld Institute of Biochemistry, London.

Success in the treatment of the mental disease, involuntal melancholia, by the sex hormone, theelin, was reported by Dr. August A. Werner and associates at St. Louis University School of Medicine.

A method for and preliminary results of transplantation of living grafts of thyroid and parathyroid gland tissues in human patients were reported by Drs. Harvey B. Stone, J. C. Owings and George O. Gey, Johns Hopkins Medical School, Baltimore.

Amidopyrine and chemically related headache and pain-relieving remedies are one if not the sole cause of agranulopenia, fatal bone marrow disease which has been on the increase in recent years, Drs. F. W. Madison and T. L. Squier, Milwaukee, reported and research by many other scientists, including Drs. Roy R. Kracke and Francis P. Parker, Emory University, confirmed.

A substance in the kidney excretion of expectant mothers that produced a tenfold decrease in the growth of cancers in mice was discovered by Drs. Henry J. Ullmann, Fritz Bischoff and Richard D. Evans and L. C. Maxwell, chemist, Santa Barbara, Calif., Cottage Hospital, the International Cancer Research Foundation, Philadelphia, announced.

The cancer-producing property of mineral oil is related closely to the oil's refractivity constant, Dr. C. C. Twort and J. W. Twort of the Manchester, Eng., Committee on cancer found; selection or treatment of lubricating oils with this fact in mind may result in lessening of skin cancer among textile workers, known as mule spinners' cancer, they suggested.

One of the normal constituents of the body, a bile acid, was transformed by simple chemical means into a cancer-producing substance by Dr. J. W. Cook and associates at the

London Free Cancer Hospital under a grant from the International Cancer Research Foundation.

The venom of an Indian snake, *Vipera russellii*, contains a substance which very rapidly clots both normal and hemophilic blood in the test tube and which was successful in checking bleeding after dental and other operations in both normal and hemophilic patients, Dr. R. G. Macfarlane, St. Bartholomew's Hospital, London, and Burgess Barnett, curator of reptiles, Zoological Society of London, reported.

Ability to hasten blood-clotting and thus to control hemorrhage is a property of human milk, fresh or dried, but not of milk from other animals, Prof. A. Solé of Vienna reported.

Deaths from peritonitis, often fatal infection following abdominal operations, may be reduced by vaccination with a concentrated fraction of bovine amniotic fluid, Drs. Herbert L. Johnson and Edward L. Young, Boston, announced.

A derivative of morphine, dihydrodesoxymorphine-D, made by Dr. Lyndon F. Small, University of Virginia, was patented and will be manufactured under government license for use on patients in order to determine whether it is habit-forming like morphine.

A serum, believed to be the first, that counteracts the effect of the often fatal bite of the black widow spider was perfected by Dr. Fred D'Amour, University of Denver professor.

New knowledge of how pancreatic enzymes or ferments become active was obtained with the extraction of a new and potent protein-digesting enzyme, chymotrypsin, and a new protein, chymo-trypsinogen, by Drs. M. Kunitz and J. H. Northrop, Rockefeller Institute laboratories at Princeton, N. J.

The outbreak of amebic dysentery starting in Chicago during the fall of 1933 was found by the Chicago City Health Department to be caused by sewage contamination of the water supply of two Chicago hotels.

The cysts which transmit amebic dysentery can be filtered out of water by the usual filtration methods used to purify water supplies, Dr. Bertha Kaplan Spector, U. S. Public Health Service, and John R. Bayliss and Oscar Gullins, chemists of the Chicago Department of Public Works, found in experiments at the Chicago Experiment Filtration Plant.

Complete degeneration of myelin sheath segments of the nerves resulting from strong alcoholic intoxication is permanent, but the slight irritative changes from mild daily in-

toxication are quickly repaired, Dr. C. C. Speidel, University of Virginia Medical School, learned from observation of frog tadpoles.

A new precise method for destroying successive layers of nerve cells from the brain cortex, thus greatly facilitating the study of localization of function, was announced by Dr. J. G. Dusser de Barenne, Yale School of Medicine.

Alcoholic neuritis, serious nervous disease resulting in paralysis and often death, is due to lack of food and not to the poisonous effect of the alcohol on the peripheral nerves of the body, Dr. Maurice B. Strauss, Thorndike Memorial Laboratory, Boston, reported.

Scurvy-preventing vitamin C is manufactured in the body of infants up to the age of five months, Paul Rohmar, N. Bezsonoff and Ursula Sanders, of the medical faculty of the University of Strasbourg, reported.

Spectrum analysis of vitamin E, which makes possible the identification of this food factor by physical measurements as well as by feeding experiments with animals, was accomplished for the first time by Drs. A. J. P. Martin, T. Moore, Marion Schmidt and F. P. Bowden, Dunn Nutritional Laboratory, University of Cambridge, England.

A new rickets-preventive was found in cholesterol sulfonic acid, chemical relative of vitamin D, Prof. Lester Yoder, Iowa State College and Iowa Agricultural Experiment Station, announced.

A dietary factor which can prevent hemorrhage in chicks and may be a new hitherto unknown vitamin was found in seeds and cereals by H. Dam of the Biochemical Institute, University, Copenhagen.

Tetany, severe nervous and muscular disease featured by painful muscular cramps and not to be confused with tetanus or lock-jaw, can be cured or greatly relieved by treatment with "A.T.10," a chemical fraction of irradiated ergosterol or vitamin D, Dr. I. Snapper, professor of medicine and general pathology, University of Amsterdam, reported.

A thermocouple that gives the temperature of air deep in the lungs by measuring the temperature of each breath was devised by Dr. Francis G. Benedict, director of the Boston nutrition laboratory of the Carnegie Institution.

Verification of the fact that the blindness-causing form of the tropical disease, onchocerciasis, is widespread in the Belgian Congo and that about one-third of the wild-flies, regarded as chief carriers of the malady, are infected with the disease was made by a Harvard University expedition under the direction of Dr. Richard P. Strong.

Azochloramide, new germicide and disinfectant that kills bacteria without injuring living tissues and does not break down in the presence of organic matter, was announced by Dr. Franz C. Schmelkes and associates of Wallace and Tiernan Research Laboratories, Belleville, N. J.

Physics

Radioactivity was created by an external cause for the first time when Prof. F. Joliot and Mme. Irene Curie-Joliot, Institute of Radium, Paris, bombarded boron, magnesium and aluminum with alpha particles with the result that positrons were given off after the bombardment was stopped.

Chemical proof of artificial transmutation

was obtained by Prof. F. Joliot and Mme. Irene Curie-Joliot, Institute of Radium, Paris, as a result of their production of artificial radioactivity.

Artificial production of radioactive elements useful in medicine and superior in intensity to the rays of radium was predicted at the International Conference on Physics by Prof. F. Joliot and his wife Irene Curie-Joliot who discovered the way to make many elements radioactive.

Carbon is made artificially radioactive with a delayed production of positrons is produced by bombardment with deuterons accelerated with a million-volt tube, Prof. C. C. Lauritsen, R. Crane and W. Harper, California Institute of Technology, demonstrated.

Artificial radioactivity was produced in graphite (carbon) by bombardment with 600,000 volt protons with the production of positrons, Drs. J. D. Cockcroft, C. W. Gilbert and E. T. S. Walton, Cambridge, England, demonstrated.

Alpha particles are ejected from lithium at speeds greater than the swiftest radioactively-produced alpha particles when lithium is bombarded with deuterons, Cavendish Laboratory experiments showed.

A way to make common element sodium radioactive by artificial means—and yield gamma radiation over twice as penetrating as that from natural sources—was discovered by Prof. Ernest Lawrence, and Drs. Edwin McMillan and Malcolm C. Henderson at University of California.

On basis of experiments on bombarding heavy uranium with neutrons Prof. Enrico Fermi, Italian physicist, predicted the early discovery of a whole series of radioactive elements lying between thorium and actinium in the periodic table.

Artificially produced gamma radiation having penetrating power equal to 3,500,000 electron-volts of energy was reported by Drs. C. C. Lauritsen and H. R. Crane of California University.

A theory of the origin of the mysterious cosmic rays was advanced by Prof. F. Zwicky of California Institute of Technology and Dr. W. Baade of Mt. Wilson Observatory which says the rays are caused by the sudden flare-up, or bursts of energy, from the type of star known as super-novae.

Cosmic rays were deflected by strong electric fields for the first time in the laboratories of Stuttgart University by Ernst Lenz, pupil of Prof. Erich Regener, world-famous cosmic ray authority, indicating that much of the radiation is corpuscular in nature.

For the first time the intensity of cosmic rays was found to vary with different times of the day, the maximum occurring at noon and minimum between 9 p. m. and 3 a. m., by Dr. Victor F. Hess of the University of Innsbruck working in the Tyrol Mountains, 7,600 feet above sea level.

Partial annihilation of matter, the building-up process whereby heavier elements could be formed from atoms of hydrogen, is responsible for the formation of cosmic rays, Dr. R. A. Millikan declared.

While cosmic rays are now known to consist of a mixture of corpuscular particles and photons of light the particle part of the rays accounts for from 90 to 98 per cent. of the total intensity at the top of the atmosphere, Dr. T. H. Johnson of Bartol Research Foundation estimated.

Plans were announced by Dr. A. H. Compton for extended cosmic ray research with

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small unmanned free-flight balloons which would transmit by radio the data being obtained in automatic instruments miles above the earth.

Cosmic ray measurements 820 feet below the surface of the Red Sea indicate that a large share of cosmic radiation consists of electrical particles, contends Prof. W. F. G. Swann of Bartol Research Foundation.

Radiation resembling cosmic rays but less penetrating is thrown out by the tops of thunderstorm clouds, Dr. B. F. G. Schonland, South African physicist reported.

Hardest cosmic rays so far discovered (penetrating more than 800 meters or 2620 feet of water) were discovered by Dr. Axel Corlin, University of Lund, Sweden, through experiments in an iron mine.

The formation of positrons from cosmic or gamma rays received support from calculations by Drs. W. Heitler and F. Sauter, of Bristol and Berlin.

Cosmic rays are charged particles, not radiation, Drs. A. H. Compton and R. J. Stephenson, University of Chicago, concluded on the basis of cosmic ray meter records of the Settle-Fordney stratosphere 11-mile high flight.

Evidence accumulated that a trinity of particles—neutron, positron and electron—compose all the matter of the universe.

Following Dr. R. M. Langer's and Dr. Carl Anderson's early prediction, renewed suggestions that there exists a new atomic particle—the negative proton—were advanced by Dr. S. Tolansky of the Imperial College of Science, London, and Prof. G. Gamow of the Polytechnical Institute, Leningrad, U. S. S. R.

A new atomic particle—a double weight neutron—was suggested by Dr. M. A. Tuve of Carnegie Institution in Washington.

Experimental proof of conversion of radiation (cosmic or gamma rays) into matter (electrons or positrons) was questioned by Dr. Carl D. Anderson, California Institute of Technology, who holds that when lead or aluminum is bombarded rays merely knock out particles already existing in atomic nuclei.

A new source of protons for atomic bombardments, consisting of an electric arc operating in hydrogen at low pressure between an incandescent filament and a metal electrode, was devised by Drs. Edward S. Lamar and Overton Luhr, Massachusetts Institute of Technology.

Fast electrons, as well as cosmic and gamma rays, may give rise to pairs of negative and positive particles when they hit nuclei of atoms, Dr. D. Skobel'tzyn, Leningrad, found.

Prof. Enrico Fermi of Italy discovered the type of artificial radioactivity in which a negative electron or beta particle is liberated—as contrasted with the liberation of the positron in the Joliot experiments—by bombarding elements with neutrons.

That the half-life or rate of decay, of artificial radioactive materials is different for the same substance when produced in different ways was shown by the experiments of Drs. C. C. Lauritsen, R. Crane, and W. Harper, California Institute of Technology, who found that, when they turned carbon into nitrogen by bombarding it with deuterons, the half-life of the material was different from the nitrogen made by the Joliot in Paris by bombarding carbon with alpha particles.

The positron is the shortest lived thing in the universe and dies when absorbed by matter as predicted by the Dirac theory, Prof. F. Joliot and Prof. Jean Thibaud, French scientists, determined independently.

Using instruments counting individual photons of light, Swiss scientists, Edgar Meyer, M. Schein and B. Stoll have been able to detect a new band of invisible light in the ultraviolet in the region from 2,400 to 1,900 Angstrom units.

By free-flight balloon ascensions Prof. Erich Regener of the Physical Institute of Stuttgart, Germany, indicated that 70 per cent. of the ozone is below 19.5 miles altitude, much lower than the height previously supposed.

Invention by Prof. G. R. Harrison of Massachusetts Institute of Technology of two devices for measuring and analyzing complicated spectra are: (1) a wavelength computing machine which automatically prints wavelengths and intensities with all correction factors directly on a photographic plate, and (2) an interval sorter which performs and sorts 50,000 subtractions of wave numbers per minute.

Analysis of the observations made by American investigators during the Polar Year indicates that the temperature of the region from 62 to 124 miles above the earth is probably in the neighborhood of 80 degrees Fahrenheit.

Small periodic variations in the measurements of the velocity of light were found in the course of extensions of Michelson's experiments at Mt. Wilson Observatory, which gave a new average value, 299,774 kilometers per second, but these were attributed not to a real variation in light's speed but to other undiscovered causes.

A new theory of relativity developed by Sir Shah Sulaiman, distinguished mathematician and justice at Allahabad, India, links the classical mechanics of Isaac Newton with results predicted by Einstein's relativity.

"Photographs" of atoms magnified, in effect, 200,000,000 times obtained by the use of X-rays were exhibited by Prof. A. H. Compton and Dr. E. O. Wollan of the University of Chicago.

X-ray studies of the structure of wood fibers reveal that even, soft tone accompanies the non-orientation of the wood fibers in the maple back of a violin, Dr. K. Lark-Horovitz and W. I. Caldwell of Purdue University have discovered.

Heat-absorbing glass which removes 52 per cent. of the "hot" but invisible infrared rays and which is expected to prove useful for skylight in southern factories during hot summer months, was reported by Dr. Roger S. Estey, physicist of the Electrical Testing Laboratories, New York City, to the Optical Society of America.

Sextants and binoculars can be improved for use under certain light conditions by attaching polarizing prisms, Dr. E. O. Hulburt, Naval Research Laboratory, found.

A precise value for the velocity of sound, 1087.13 feet per second at zero degrees Centigrade, was announced by Dr. Dayton C. Miller, Case School of Applied Science, who computed data from big gun firing just after the close of the World War.

By firing a gun into the barrel of a similar gun, Dr. C. Ramsauer, German physicist, developed a method of producing high pressures and high temperatures simultaneously.

The Raman effect of heavy water (containing hydrogen isotope mass two) is different



BURST BY LIGHT

The two cells above, stomatal guard cells on the leaf of a hyacinth, are completely shattered by the action of polarized sunlight on the starch contained in them. The cell in the lower left has burst at one corner and the contents are beginning to spill out. See story on page 387.

from that of ordinary water, Dr. R. W. Wood, Johns Hopkins University, found.

Production of clear crystals of lithium fluoride transparent to 900 Angstrom units in the ultraviolet and with practically no variation in dispersion over visible spectrum, have been developed as a practical optical material in large sizes by Prof. D. C. Stockbarger of Massachusetts Institute of Technology.

Psychology and Psychiatry

Learning of the simple type known as "conditioned reflex" may take place when the brain cortex is completely missing, but a form of conditioning involving adaptation was found to depend upon functioning of the cortex in dog experiments by Dr. Elmer Culler, University of Illinois.

The association area of the frontal lobes of the brain is essential to memory of the immediate past, or ability to keep in mind several aspects of a problem while seeking the solution, it was learned from experiments with apes and monkeys performed by Drs. C. F. Jacobsen and J. B. Wolfe, Laboratories of Comparative Psychobiology, Yale University.

High frequency radio currents were used by Dr. Clarence W. Brown, University of California, to block out certain nervous centers of the brain for study of their functions without pain or injury to the animal involved and without affecting the higher cortical centers of its brain.

The successful planting of small coils beneath the skin on the heads of dogs, with direct connection to the brain, made possible, by means of induced currents, the study of special functions of brain areas without pain or injury to the animals, Dr. Roger B. Loucks, Phipps Psychiatric Clinic, Johns Hopkins University, reported.

Complete loss of the occipital lobes of the brain does not prevent dogs from learning to respond to a signal of light, although without this "visual" area the animals are unable to see objects or forms, it was discovered by Dr. Donald G. Marquis, Yale.

Salt is not a taste, but is discerned by a skin mechanism, is the conclusion of Dr. Samuel Renshaw, Ohio State University, who found that salt, unlike tastes, is more notice-

able at body temperatures than hot and can be "tasted" on lips and gums where no taste organs are present.

Temperature is perceived not through a special skin mechanism, but through the dilation and contraction of the blood vessels, Dr. John P. Nafe, Washington University, St. Louis, concluded.

An unusual case of visual defect in which the victim could not distinguish objects but saw them blurred together into one and which was cured by training in an analytical attitude was reported by Dr. D. M. Purdy, University of Kansas.

The theory that a different process makes possible the hearing of high and of low frequencies was corroborated by experiments showing that fatigue of the ear produced by a high tone affects hearing of high tones more than hearing of low tones, Dr. Clifford Pearce, Brown University, reported.

Changing the volume of a sound changes its apparent pitch, and the apparent volume is likewise dependent upon pitch, it was found independently by Dr. S. S. Stevens, Harvard University, and Dr. Harvey Fletcher, Bell Telephone Laboratories.

A clue to fundamental differences in physiological brain conditions underlying mental deficiency was found by Dr. George Kreezer, Vineland Training School, in the way in which the muscles of idiots respond to mild electric currents, their reaction resembling that of an animal with injury to higher brain centers, or that of an undeveloped fetus.

The intelligence quotients of exceptionally bright children decrease as they grow older and girls lose more than do boys, Prof. Edward A. Lincoln, Harvard Graduate School, found.

Intelligent children who are delayed in learning to talk are often sufferers from a short auditory memory span and should be taught only words containing very few sounds, Samuel D. Robbins, director, Boston Stammerers' Institute, reported.

Diabetic children taking insulin treatment are normal in intelligence, Dr. Howard West, Amytis Richey, and Mary B. Eyre, Claremont Colleges, found.

No matter how well a skill such as piano playing is learned, the mere making

of one movement is not sufficient to call forth the next and neither does consciousness of what you are doing lapse after learning, Dr. Walter S. Hunter, Clark University, found experimentally.

A comprehensive photographic atlas of infant development was completed by Dr. Arnold Gesell, assisted by Drs. Helen Thompson, Catherine S. Amatruda, Jessie J. Carlson, Alice V. Keliher, and Frances L. Ilg, all of the Clinic of Child Development, Yale University.

Athletic and mental training beginning at the age of 20 days for one of twins and at 22 months for the other, demonstrates that critical periods exist when certain types of skill or knowledge can best be learned, Dr. Myrtle B. McGraw, Babies Hospital, New York, concluded.

Effectiveness of training of young children is dependent upon the stage of development of the ability trained, was the conclusion from an experiment with identical twins by Dr. Josephine R. Hilgard, Clinic of Child Development, Yale University.

Propaganda presented through the motion picture is effective in changing attitudes on socio-economic problems, particularly those closely related to the subject matter of the film, experiments by Dr. Solomon P. Rosenthal, teacher, New York City schools, demonstrate.

Emotional propaganda presented by three means was found to be most effective in direct speech, less effective by radio, and least through print, in experiments by Dr. Walter H. Wilke, New York University.

In a comprehensive study of manual skill, Dr. J. W. Cox, National Institute of Industrial Psychology, England, found three underlying factors—a general factor (intelligence) functioning in all the activities, a mechanical factor functioning only in mechanical factors, and a routine manual factor restricted to manual tasks; skill acquired through instruction can be transferred to other tasks, skill acquired through practice cannot, he found.

The underlying characteristics of the epileptic are self-centeredness, supersensitiveness, and possibly religiousness; other traits attributed to the epileptic personality are effects of the disease, it was concluded by

Dr. Walter Freeman from a study of identical twins, one of whom was epileptic.

"Brain-stones," a rare disease in which calcium is precipitated into the small arteries of the brain, was reported by Dr. Jacob Kasanin, Rhode Island State Hospital for Mental Disease.

Scientific basis for the idea that the heart is seat of the emotions was found in experiments showing the effect of emotions on blood circulation, reported by Dr. Theodore P. Wolfe of New York City.

Dogs, like humans, vary in their individual susceptibility to nervous breakdown, it was found by Dr. Ivan P. Pavlov, Leningrad, U. S. S. R., who is following this clue in an effort to trace the inheritance of temperament.

The standardization of the laboratory material of the investigator of anthropoid apes was reported by Dr. Robert M. Yerkes as one of the primary objectives of the breeding colony of Yale's Laboratories of Comparative Psychobiology.

Chimpanzees do not use a trial and error method in solving problems, but follow a definite pattern in their responses until the correct one is found, Kenneth W. Spence, Yale University, observed.

Dogs are able to recognize words from their sound alone, it was concluded by Dr. Emanuel Sarris, Institute for Environmental Research, Hamburg, Germany, from experiments with several animals.

Rewards and Recognitions

The Nobel Prize in medicine for 1934 was awarded to Dr. George H. Whipple, University of Rochester, and Drs. George R. Minot and William P. Murphy, Harvard University, for their discoveries on liver therapy in the anemias.

The Nobel Prize Award in Chemistry for 1934 was granted to Prof. Harold C. Urey, Columbia University, for his discovery of the heavy isotope of hydrogen, deuterium.

Dr. Walter S. Adams, director of Mount Wilson Observatory, Carnegie Institution, was awarded the Janssen Medal of the Paris Academy of Sciences in recognition of his work on stellar parallaxes.

Dr. F. G. Banting, University of Toronto, one of the discoverers of insulin, was created a Knight Commander of the Order of the British Empire.

A scientific meeting was held at Iowa State College to honor posthumously the pioneer botanist founder of the laboratory at Ames, Prof. Charles Edwin Bessey,

William E. Boeing, aircraft manufacturer, received the 1934 Daniel Guggenheim medal for "successful pioneering and achievement in aircraft manufacturing and air transport."

Prof. George D. Birkhoff, Harvard University, received a first prize award from the Pontifical Academy of Science for a system for solving differential equations.

The National Academy of Sciences Elliot Medal for 1931 was posthumously awarded to Dr. Davidson Black, discoverer of Peking Man.

The Collier Trophy in aviation for 1934 was awarded to Frank W. Caldwell for his invention of controllable-pitch propellers.

Willis H. Carrier, veteran air-conditioning authority and engineer, was awarded the medal of the American Society of Mechanical Engineers.

Dr. George Ellett Coghill, Wistar Institute of Anatomy and Biology, Philadelphia, re-

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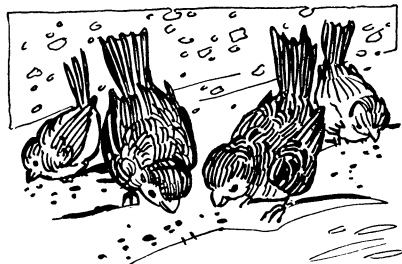
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ORNITHOLOGY

NATURE RAMBLINGS

by Frank Thone



Christmas Guests

"There was a sparrow went out to harrow
On Christmas Day in the morning!"

THERE was a whole anthology of birds and beasts that did miraculous things on Christmas Day in the morning, if we may believe the old song. Most of them were domestic animals that had to stay around anyway, but the country folk who made the rhymes did take notice that there were birds in their dooryards during the winter that did not go away, even though it was blowy and snowy and pretty nasty in general.

It is a matter for congratulation and thankfulness that we do have these feathered Christmas guests, hardy little folk who dig a living of insect eggs and larvae out of cracks, or harvest wild fruits and weed seeds. Many of them are as inconspicuous and unornamental as the sparrow celebrated in the rhyme, but some are highly ornamental, like the tanagers and the cardinal, or gifted with sheer beauty, like the cedar waxwing, or even willing to sing occasionally, like some of the sparrows.

Some of them are permanent residents that never wander far from their homes, winter or summer. The woodpeckers, bluejays and our old picaresque friend the crow are good examples. Then there are those that go south, but not very far south, and frequently wander back during mild spells, or return very early, not waiting for spring. Such are the red-winged blackbird and the horned lark. Finally, there are the real winter boarders, like the tufted titmouse, that normally summer away up in Canada and come south for the winter when there is winter in the south, never going below the line of snows.

Science News Letter, December 22, 1934

ceived the Elliot Medal for 1930, from the National Academy of Sciences.

Dr. James Bryant Conant, president of Harvard University, was awarded the American Institute of Chemists' medal for outstanding service to American chemistry.

In honor of a lifetime devoted to the study of Swedish antiquities, a Swedish farmer, Olof Christofferson, 70 years old, was created a Knight of the Royal Order of Vasa.

Dr. David Fairchild, plant explorer, formerly of the U. S. Department of Agriculture, was presented with the Public Welfare medal of the National Academy of Sciences.

The Perkin Medal of the Society of Chemical Industry was presented to Prof. Colin G. Fink, Columbia University for his development of chemical methods of restoring damaged art work.

Prof. Alfred Fowler, Imperial College, University of London, was honored with the Bruce gold medal of the Astronomical Society of the Pacific.

Dr. Cecelia Payne Gaposchkin, Harvard College Observatory, was selected by the American Astronomical Society as the first recipient of the Annie Jump Cannon prize for distinguished work in astronomy by women.

The General Electric Company received a gold medal from the American Institute of the City of New York for pioneering in industrial research.

Dr. Ralph E. Hall, director of the Hall Laboratories, Inc., received the first award of the Pittsburgh Award from the Pittsburgh Section of the American Chemical Society, honoring his researches on water conditioning.

Dr. Bjorn Helland-Hansen, Geophysical Institute, Bergen, Norway, received the Agassiz Medal of the National Academy of Sciences.

The Wetherill medal of the Franklin Institute, Philadelphia, was awarded to Prof. E. Newton Harvey, Princeton, and Alfred L. Loomis, banker-scientist, for their joint invention of the centrifuge microscope.

Capt. Stanford C. Hooper, U. S. Navy, was awarded the Institute of Radio Engineers' Medal of Honor for development of naval communications.

The \$1,000 prize of the American Association for the Advancement of Science was awarded to Prof. Reuben L. Kahn, University of Michigan, for his paper reporting the discovery that when an animal is immunized against disease, its body tissues acquire protective properties as well as its blood.

Dr. A. E. Kennelly, professor emeritus of both Harvard University and the Massachusetts Institute of Technology, for whom one of the ionized layers of the upper air is named, was awarded the 1933 Edison Medal by the American Institute of Electrical Engineers.

The Franklin Medal of the Franklin Institute, Philadelphia, was awarded to Dr. Irving Langmuir, General Electric Company chemist.

Abbé Georges Lemaitre, Belgian cosmologist, was awarded the annual prize of the Francqui Foundation.

Mrs. Anne Morrow Lindbergh was awarded the Hubbard gold medal of the National Geographic Society for her accomplishments as radio operator, navigator and copilot on the Lindberghs' aerial circumnavigation of the Atlantic in 1933 and their flight to Asia in 1931.

Dr. Waldemar Lindgren, Massachusetts Institute of Technology, received the Penrose Medal from the Geological Society of America.

Dr. Jacob Goodale Lipman, Dean of Agriculture, Rutgers University, received the Chandler Medal in Chemistry from Columbia University for outstanding achievements in agricultural chemistry.

The Chemical Industry Medal for 1934 was presented to Dr. Floyd J. Metzger of

Christmas Meetings

News of the coming meetings of the American Association for the Advancement of Science and affiliated organizations will come to you soon in the pages of the SCIENCE NEWS LETTER. Four members of the Science Service staff will attend the meetings, temporary editorial offices being established in the Schenley Hotel, Room 322. Staff members in Pittsburgh will be: Watson Davis, Director; Dr. Frank Thone; Robert Potter and Miss Emily Davis.

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the Air Reduction Co. for his contribution to the field of rare atmosphere gases which make possible varicolored advertising signs.

The Joseph Leidy medal was presented by the Academy of Natural Sciences in Philadelphia to Gerrit Smith Miller, Jr., U. S. National Museum, for his distinguished research on mammals.

The Wetherill medal of the Franklin Institute was awarded to Dr. Johann B. Ostermeier of Augsburg, Germany.

In honor of his 85th birthday, Dr. Ivan P. Pavlov was awarded by the Soviet government an annual pension of 20,000 rubles (\$17,600), and 1,000,000 rubles (\$880,000) for the enlargement of the physiological laboratories.

The Franklin Medal of the Franklin Institute, Philadelphia, was awarded to Prof. Henry Norris Russell, Princeton astronomer.

The Mary Clark Thompson Medal of the National Academy of Sciences was awarded to Dr. Charles Schuchert, Yale University, for his important work in the classification and distribution of paleozoic invertebrates and for his contributions to historical geology and paleogeography.

The gold medal of the Royal Astronomical Society, London, was awarded to Dr. Harlow Shapley, Director of Harvard College Observatory, for his work on the structure and dimensions of the galactic system.

Dr. Henry C. Sherman, Columbia University, was honored with the William H. Nichols Medal of the New York Section of the American Chemical Society for investigations showing that chemistry, through nutrition, may raise the health level and lengthen life.

Frank Julian Sprague, "The Father of Electric Trolleys," was awarded the John Fritz Medal by a group of engineering societies, but died before its presentation.

Capt. Albert W. Stevens, Army Air Corps, was awarded the Franklin L. Burr \$1,000 prize by the National Geographic Society for his aerial photography, especially his photograph of the moon's shadow from 26,000 feet altitude during the 1932 total solar eclipse.

Dr. Lewis B. Stillwell, electrical engineer and inventor, was awarded the 1933 Lamme Medal of the American Institute of Electrical Engineers.

Dr. Edward L. Thorndike, psychologist and educator, Columbia University, was elected president of the American Association for the Advancement of Science for 1934.

The Willard Gibbs Medal, of the American Chemical Society's Chicago section, was awarded to Prof. Harold C. Urey, Columbia University, for his researches on heavy hydrogen, deuterium.

The Remington Honor Medal for 1934 was awarded to Sir Henry Wellcome, founder of the Wellcome Physiological and Chemical Research Laboratories, by the American Pharmaceutical Association.

Dr. David White, U. S. Geological Survey, received the first award of the Charles Doolittle Walcott Medal and honorarium of \$1,350 from the National Academy of Sciences in recognition of his research on the pre-Cambrian algae of the Grand Canyon of Arizona.

Pope Yeatman, New York consulting mining engineer, received the William Lawrence Saunders Gold Medal for 1933 from the American Institute of Mining and Metallurgical Engineers.

Science News Letter, December 22, 1934

• First Glances at New Books

Physics

ATOMIC STRUCTURE AND SPECTRAL LINES. New revised ed.—Arnold Sommerfeld—*Dutton*, 675 p., \$10.80. This book, the English translation by Dr. Henry L. Brose of the Fifth German edition, will be welcomed by American chemists and physicists who can struggle through a German text on physics by leaning on a dictionary but are not quite proficient enough to catch the intricate shades of meaning of the language without much effort. Since the familiar Bohr atom theories now appear only as a jumping-off place for the newer quantum mechanics the subject is sufficiently difficult without worrying about German translation. Hamiltonian mechanics which formerly appeared in the appendix now occupy a prominent position in the book. Professor Sommerfeld promises a second correlative volume entitled "Wave Mechanics" to go with the present fundamental one on atomic physics.

Science News Letter, December 22, 1934

Sociology

RACE RELATIONS—Willis D. Weatherford and Charles S. Johnson—*D. C. Heath*, 590 p., \$3.20. Written by two professors, one white, the other a negro, this study of the sociological problems of the Negro in America is said to be unique. Prof. Weatherford has, generally speaking, contributed chapters on the more familiar and expected topics in a sociology text book. Prof. Johnson offers an insight into the home life of the Negro, his psychological attitudes, his migrations, and economic struggles.

Science News Letter, December 22, 1934

Astronomy

THE STANDARD SCALE OF SOLAR RADIATION—C. G. Abbot and L. B. Aldrich—*Smithsonian Institution*, 3 p., 5c.

Science News Letter, December 22, 1934

Economics

INTERNATIONAL ECONOMIC RELATIONS—Report of the Commission of Inquiry into National Policy in International Economic Relations—*Univ. of Minnesota*, 397 p., \$3. Robert M. Hutchins, William Tudor Gardiner, Carl

L. Alsberg, Isaiah Bowman, Guy Stanton Ford, Beardsley Ruml and Alfred H. Stone express their opinions as to what political, economic and administrative measures should be taken by the American Government to further national and international economic recovery. Summaries of the hearings held and of briefs submitted together with explanatory reports are included.

Science News Letter, December 22, 1934

Arithmetic

ARITHMETIC IN AGRICULTURE AND RURAL LIFE—C. A. Willson—*Edwards Brothers, Inc., Ann Arbor, Mich.*, 162 mimeographed leaves, \$1.80. In these days, farmers can no longer "figure everything out in their heads" or on the barn door with a piece of chalk. At present there is the necessity (temporary at any rate) for AAA crop-control arithmetic; eventually farmers may even need to figure income tax returns again. These, fertilizer figures, crop weights and measures, kitchen budgets for the wife, and a lot more besides, can be learned from this unique textbook, which winds up with a four-place logarithm table.

Science News Letter, December 22, 1934

Exploration—Biography

EARTH CONQUERORS—J. Leslie Mitchell—*Simon and Schuster*, 370 p., \$3.50. Nine great explorers, from Leif Ericsson to Fridtjof Nansen, rub elbows in this book. The explorers are chosen because they ventured, not for loot, fun, or fame, but drawn by an overwhelming urge to seek the "Fortunate Isles" that they dreamed of beyond the known horizon.

Science News Letter, December 22, 1934

Astronomy

THE TELESCOPE—*Published bi-monthly by the Bond Astronomical Club at Harvard University*, \$1. per year; single copies 25c. New magazine on popular astronomy finely illustrated. Recent issues have offered simple descriptions of the great Dunlap Observatory of the University of Toronto and an article by Dr. John Strong on the process of evaporating aluminum on telescope mirrors.

Science News Letter, December 22, 1934

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