

REVIEW OF THE YEAR

Science Advances in 1938

New Heavenly Bodies; Unproved Atomic Particles; Synthetic Fiber; Attacks on Social Problems Mark 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 25 and also the issue which will appear next week, Dec. 31).

FOR FEMININE beauty, a new fiber that promises to replace silk in stockings commercially in a year or two. For air transport, still bigger planes. For cigarette smokers, a remedy for blue mold threatening tobacco growing. For all of us, new disease conquests and promise of more effective distribution of medical service.

In such practical ways science advanced markedly in 1938. In the reaches of the universe and in the depths of atomic matter, new bodies, unknown star clouds, unseen satellites, unproved particles, were found. Mathematicians carved new intellectual tools. Psychologists and psychiatrists probed deeper into normal and abnormal human behavior of persons and nations. Man was buffeted by hurricane and flood.

Science-made might poised by ruthless madness threw the world into a fear psychosis that threatened to stifle science-born democratic civilization. Intolerance, creeping like a horrible malignancy, sabotaged true scientific research where once knowledge's fountains played.

Resolved to save itself and the rest of civilization, the world of science moves forward into 1939.

AERONAUTICS

Largest Aircraft Launched; Safety Devices Developed

AVIATION'S outstanding 1938 achievement is the successful launching and flying of the two largest aircraft ever built for transport service—the Douglas DC-4, 42-passenger landplane and the largest such in the world; and the Boeing Clipper, designed for trans-

atlantic service and the largest commercial seaplane in the world today.

Other noteworthy developments included:

The Civil Aeronautics Authority was created by Congress to control civic aviation.

The Hughes Round-the-World record flight was a convincing demonstration of precision flying. The accuracy of navigation was made possible largely by an automatic calculating device used for the first time on this flight.

A practical absolute altimeter, telling height over the nearest obstacle rather than height above sea level, was developed.

The automatic direction finder, which makes possible rapid and accurate determination of a plane's position while flying blind, was introduced.

A cartridge static suppressor was added to the loop antenna to banish 95 per cent. of static.

The National Advisory Committee for Aeronautics added to its Langley Aeronautical Laboratory a refrigerated tunnel, a large free flight tunnel and a large variable density wind tunnel.

The tri-cycle landing gear was introduced in transport airplane design, probably to become standard for future commercial planes.

Transcontinental airlines began using oxygen for pilots flying above 8,000 feet on regularly scheduled runs.

A plane made from plastic-bonded plywood, with mass production potentialities, was successfully demonstrated.

The world's first ultra high frequency airway radio range system was installed in Australia.

The sleeve-valve engine was placed in service on military and commercial aircraft in England.

The Collier Trophy was awarded the Army Air Corps for development and operation of the first successful "stratosphere" airplane—the Lockheed XC-35.

ANTHROPOLOGY—ARCHAEOLOGY

Egypt and Peru Were Scenes Of Spectacular Discovery

UNSETTLED conditions, particularly in Palestine, prevented a number of archaeological expeditions from taking the field. However, Egypt and Peru, lands associated with glamor, were scenes of spectacular discovery. At Sakkara, a necropolis of 20,000 mummies came to light, as well as a tomb which may have sheltered the mummy of Aha Menes, the first of united Egypt's long line of Pharaohs. In Peru, the gold and silver contents of a prehistoric burial mound were transferred safely to the National Museum at Lima, and the array of images, jewelry, and household articles was

called Peru's greatest discovery of Indian treasure since the days of Pizarro.

Other researches of the year included:

The third and latest Pithecanthropus skull from Java proved unique in its arched similarity to Peking Man's skull type; also Pithecanthropus was established more definitely as about 500,000 years old and therefore a primitive who lived past his time.

Racial melting pots, and no one superior people, created Old World civilization, it was indicated by study of ancient burials in the Near East and India.

The fundamental type of white men, originating in Iran, had long heads and hooked noses, according to anthropometric data on 3,000 individuals.

Discovery of two thigh bones of Peking Man confirmed the supposition that this early human walked erect.

A new-made restoration model shows what the Sinanthropus woman looked like.

Evidence pointing to presence of early prehistoric Americans was unearthed at Borax Lake, California.

Weapons of the much-sought Folsom hunters of ancient America were found as far north as Saskatchewan and Alberta, Canada.

King Solomon's seaport, Biblical Ezion-Geber on the Red Sea, was excavated.

A Hittite palace found in Syria yielded records and evidence of the little-known "dull" period between the two eras of Hittite expansion.



AMERICAN MUMMY

This American of many centuries ago, a part of the annual exhibit of the Carnegie Institution of Washington, was preserved for modern eyes by a method very different from that of the ancient Egyptians. The Basket-Makers had no art of embalming; their mummies resulted from the natural drying out in the arid air of their caves. Exhibiting the mummy is the archaeologist E. H. Morris.

Digging to bedrock at Biblical Armageddon, archaeologists counted 20 cities on the site and studied walls and buildings of the earliest settlements.

The first stone temple ever found on Peru's coast revealed a new type of prehistoric Indian culture there, probably originating in the highlands.

A Lithic Laboratory for study of Stone Age arts opened its doors at Ohio State Museum on January 1.

First definite archaeological evidence that cotton was cultivated in Mexico about 2,000 years ago was found in the form of a textile fragment.

Viking sword and armor unearthed in northern Ontario may prove to be conclusive evidence that Norsemen reached the Canadian interior about 1000 A. D.

New buildings were found at Rome's ancient seaport Ostia, as archaeologists pushed the ambitious project of unearthing the ruins completely by 1942.

The boundary stone of the Athenian Agora was found.

Skeletal remains found in a huge burial mound in the Aleutian Islands, off Alaska, were pronounced probably ancestral in type to some western Indian tribes.

Industrial aspects of aboriginal America were shown by excavation of a trade town in Honduras, where Indians turned out cheap clay wares in quantity.

Some of the strange stone monuments called menhirs left by prehistoric peoples may have memorialized feasting, not funerals, judging by a study of Naga tribes of Assam, the only living people erecting such markers.

ASTRONOMY

Find Two New Satellites Of the Planet Jupiter

THE discovery of two new satellites of the planet Jupiter, its 10th and 11th, was an outstanding achievement of astronomy during 1938. Satellite 10 was found to have direct motion while satellite 11 has retrograde motion.

Other highspots of 1938's astronomical advances included:

Flaming solar prominences, over a million miles high and a new record, were reported.

Total eclipses of the moon occurred in May and November while the sun showed a total eclipse in May, a partial eclipse in November.

Dome and housing for the 200-inch telescope on Mt. Palomar, Calif., was completed.

Gale's comet, absent for eleven years, was rediscovered.

A new solar radiation observatory was begun on an 8,000-foot peak in the Burro Mountains of New Mexico.

Gigantic star clusters, unlike any previously known class of cosmic systems, were discovered in the southern constellations of Sculptor and Fornax.

A glowing mass of luminous hydrogen and oxygen gases was discovered to envelop a large portion of the Milky Way.

A new hypothesis of the origin of the radiant energy of stars, involving the concept of nuclear reactions with resonance energy values, was developed.

A new giant double star of the eclipsing type was discovered in the constellation of Scorpio.

New measurements added seven miles to the diameter of the planet Venus.

The size and physical characteristics of the important eclipsing binary system containing the star Zeta Aurigae were determined.

Independent studies showed the presence of a tremendous, low-density globe, of scattered stars around our galaxy, the Milky Way.

The sum of \$647,700 was provided for a 50-year research program on the direct utilization of solar radiation as a source of power.

A new type galvanometer, claimed to be more than 20 times as sensitive as any other instrument of its class, was devised to study the individual parts of stellar radiation.

While searching for a way to produce in the laboratory the rays of light coming from the sun's corona, a new type of continuous radiation was discovered in the spectrum of helium.

Punch card automatic computing machines were used to check the application of Newton's laws of gravitation to the motion of the moon.

One of the most accurate astronomical mirror grinding jobs ever undertaken, the 82-inch diameter mirror for McDonald Observatory, was completed.

Because the planet Pluto may be covered with a layer of liquid air, astronomers believe that estimates of its size will have to be increased.

Eros, small planetoid, came within 20,000,000 miles of the earth.

Plans for a 118-inch diameter reflecting type telescope were announced in Russia.

BIOLOGICAL SCIENCES

Tobacco Saved From Mold; Vitamin Discoveries Made

THE advance of the biological sciences was marked by important practical applications as well as by new discoveries in "pure" biology. Congress provided for the establishment of four regional laboratories for research into industrial uses for farm surpluses. A method was perfected for stopping the blue mold disease of tobacco, which threatened to wipe out the industry in parts of the country, by means of benzol vapor. Vitamin B₁ was found necessary for the growth of roots. The sugar and vitamin B₁ needed by plants' roots are formed in their tops, it was discovered. Nicotinic acid, part of vitamin B, was found to cause more vigorous life in leaves.

Other advances included:

Living cells can survive freezing in liquid air, if they are first partially dried and then chilled very quickly, it was found.

It was announced that injured cells produce substances that may speed the growth of uninjured cells, a discovery that may contribute to knowledge of cancer and treatment of burns.

Plants were found to thrive better on full sunlight than on any artificial mixture of colored lights.

Tobacco seeds germinated after being dormant for 60 years.

Plant cells separated from their parent tissues were kept alive for more than a year.

Plant hormones were applied in the form of dust to seeds to speed sprouting, the few days thus gained having important economic significance in regions having short growing seasons.

Trimethylamine, naturally present in many plants and animals, was found to have physiological effects like those of a sex hormone.

A new disease menaced persimmon trees, valuable as sources of food for wildlife and material for wooden golf clubs.

An entirely new kind of chlorophyll was discovered in the leaves of jimson-weed.

The claimed speed of over 800 miles an hour for the Mexican deer botfly was debunked; best speeds of insects are only about 60 miles an hour.

A "soilless farm" on Wake Island in the Pacific produced four crops of vegetables.

The milky sap of the creeping fig was discovered to be deadly to insect parasites of plants.

A new synthetic insecticide renders the U. S. less dependent on imported pyrethrum.

It was found that starfish, enemies of oysters, can be killed by dropping quicklime on them.

Much of New England's valuable timber was destroyed by a hurricane.

The first meeting of the South American Botanical Union was held in Rio de Janeiro.

An albino bison bull was brought to the U. S. National Zoological Park in Washington, D. C.

The hundredth anniversary of the cell theory was celebrated.

Strong evidence was produced that corn is descended from pod-corn, not from teosinte as often supposed.

Use of respiration pigment from the blood of horseshoe crabs enabled tissues to live longer in the Lindbergh-Carrel "glass heart."

Cool, wet spring weather greatly reduced the feared plagues of grasshoppers and chinchbugs.

The annual award of the American Association for the Advancement of Science was given to Dr. Philip White of the Rockefeller Institute for Medical Research.

The Agassiz Medal for Oceanography was awarded by the National Academy of Sciences to Dr. E. J. Allen, director emeritus of the Plymouth Laboratory of the Marine Biological Association of the United Kingdom.

The gold medal of the American Institute was awarded to Dr. William H. Crocker, director of the Boyce Thompson Institute for Plant Research.

The first Isaac Adler prize was awarded by Harvard University to Dr. W. M. Stanley of the Rockefeller Institute.

The Eli Lilly and Company research award was granted to Dr. Frank L. Horsfall, Jr.

Two new and elaborately equipped institutes for scientific research were founded by pharmaceutical companies.

CHEMISTRY—PHYSICS

New Fiber Rivals Silk; Unknown Particles Sought

FROM the basic ingredients of coal, fair and water scientists achieved the highlight of physics and chemistry for the year 1938, when they produced the material named nylon. Out of nylon can be made fibers that rival natural silk in fineness, strength and elasticity and it can be formed, also, into a whole variety of coarser fibers such as sewing thread, tooth brush bristles and artificial horse hair.

Other outstanding events included:

Experiments at 14,200 feet disclosed a most penetrating component of cosmic radiation which is believed to be caused by a new kind of atomic particle, known as the neutretto.

The largest molecular particles, having a



NO SILK

These delicate stockings are made of "nylon," a man-made fiber superior in many qualities to silk. The discovery of nylon, which can also be made into coarser fibers for such things as toothbrushes, is an important discovery of this year. (See, SNL, Oct. 1). A close-up of the stocking is shown in the background. The thin line visible at the left is a human hair shown for comparison. The coarse strand is number sixty cotton sewing thread.

molecular weight of 100,000,000 were isolated by a special apparatus resembling a treadmill for ions in solution.

Experiments believed to indicate the presence of long-sought but never-found particle, the neutrino, were reported.

The Nobel prize in physics for 1938 was awarded to Prof. Enrico Fermi of the Royal University, Rome, Italy, for his discoveries on transmutation of the elements by neutron bombardment and for his investigations in theoretical physics.

A Nobel prize in chemistry for 1938 was not awarded.

Mesotron was suggested as the name of the X particle discovered in 1937 with mass intermediate between those of the electron and proton.

The amazing property of mesotron particles to penetrate dense materials like lead more easily than they can pass through an equivalent amount of air, a matter which has baffled scientists, was explained by experiments indicating that the particle suffered radioactive decay with a mean life of about two-millionths of a second.

With a new order of accuracy the energy levels in the nucleus of the fluorine atoms, which produce gamma ray emission in bombardment experiments, were determined in tests throwing new light on the little understood nuclear reactions.

An electrical velocity selector was developed for producing highly collimated beams of thermal neutrons that is expected to have great value for more accurate nuclear disintegration research.

A new determination of the energy changes in the transmutation of beryllium into lithium made possible a more precise value for the mass of the beryllium atom, much used in disintegration experiments.

Gyroscopic spin in the nucleus was assigned as the reason for the amazingly long "life" of the radioactive isotope of rubidium which takes a hundred billion years to decrease its radioactivity by one half.

Evidence that super-heavy elements 93 and 94 can be created by atomic bombardment of uranium was amply confirmed by independent tests.

All the chemical elements, except two, were found to have yielded to the ancient alchemical dream of transmutation.

World's flattest diamond, a three carat, \$4,000 gem, was used in X-ray refraction experiments measuring the fundamental constant of physics, e/m .

Atoms of the active alkali metal sodium were identical as a constituent of the earth's atmosphere.

The fleeting rays of sunlight at dusk were used to study the temperatures found high in the upper atmosphere.

A new atmospheric gas, a combination of oxygen and nitrogen, was discovered to exist at from 10 to 25 miles above the earth's surface.

High-flying balloon ascensions, with robot instruments replacing human observers detected bands of cosmic ray energies which can best be interpreted by the annihilation of common atoms like oxygen, nitrogen, carbon and aluminum.

A new and more complete catalogue of the spectrum lines of the elements was prepared for publication.

Although far from ready to tackle its primary objective of creating high speed atomic particles, the 225-ton cyclotron apparatus at the University of California was used in its first scientific experiments when its giant magnet split a ray of light in spectroscopic research.

A way to use dual X-ray tubes, each working in turn off the half cycle of alternating current, was developed and promises to make them last longer.

Dry silica gel was developed as a "sponge" for storing radium, promising to replace less convenient radium storage in solution.

By hydrogenation, success was achieved on an experimental scale in the long-sought goal of converting hitherto waste lignin into such valuable materials as an organic solvent, wood alcohol, a lacquer solvent and a glassy, clear resin. An additional use found was as a water-softening agent.

A new drying agent, activated alumina, was introduced.

Methods of polymerizing gasoline were announced; these potentially increase, by 150 per cent., the nation's supplies of crude petroleum.

A new cellulose wrapping film, glass-clear and moisture-proof, was developed.

A new growth chemical, known as biotic acid, was discovered in liver.

A new, faster and continuous process for the production of rayon, first of its kind in the world, went in commercial operation.

The Priestley Gold Medal of the American Chemical Society was awarded to Prof. Marston Taylor Bogert of Columbia University.

Coal mine waste water was found to breed bacteria capable of turning dread carbon monoxide into harmless carbon dioxide.

Super-sonic waves were found to reduce to a powder certain laminated materials like mica.

EARTH SCIENCES

Hurricane Brings Havoc To New England Coast

THE outstanding single event in earth sciences during 1938 was the worst hurricane in New England history on Sept. 21, causing millions of dollars' worth of damage, disrupting travel and communication for days, and destroying many of the famous white pines and other forest trees of the southern half of the region. Except for this one storm, the hurricane season of this year was a rather light one, with only four or five tropical storms of notable magnitude approaching the southern U. S. coasts.

Other occurrences were:

One of the most severe earthquakes on record occurred on Nov. 10, centered on the ocean bottom about 250 miles south of the Alaska peninsula.

The epicenters of 44 earthquakes were determined by seismologists of the U. S. Coast and Geodetic Survey and the Jesuit Seismological Association, using data collected telegraphically by Science Service.

A vast ice field was discovered in interior Alaska.

A big strike of high-grade (*Turn to Page 414*)

CHEMISTRY

Solves Two-Year-Old Puzzle Of Surface Tension Behavior

Peculiar Behavior of Solutions of Very Weak Concentration Has Led To Measurement Errors

FOR NEARLY two years now chemical circles have been puzzling over a curious surface tension effect first observed by Prof. Grinnell Jones and Wendell A. Ray of Harvard University.

Back in January, 1937, they reported to the *Journal of the American Chemical Society* that in certain solutions of very weak concentration a particular point could be reached where the surface tension became less than that of water, although in higher concentrations the surface tension was more than for water. This curious, and previously unexplained, phenomenon has become known as the Jones-Ray effect.

Dr. Irving Langmuir, General Electric's Nobel Prize winning chemist, however, has just reported (*Science*, Nov. 4) an explanation of the previously baffling phenomenon.

Although Prof. Jones and Mr. Ray took every precaution to measure the diameter of their tiny capillary tube exactly, they were in error for an unforeseen reason, explains Dr. Langmuir. The rise of the solution in the tube, it should be noted, can be used to determine surface tension forces.

At certain concentrations of the solutions, Dr. Langmuir proves in his complex mathematical report, the effective diameter of the capillary tube would be smaller than any measurement could ever show.

The reason, he adds, is that at these concentrations a tiny film of water is held against the inner surface of the tube and is bound by electric charges. Thus the effective diameter of the tube is less than its real diameter. While the difference is very small it can account for the curious decrease in surface tension observed by the Harvard scientists.

Surface tension is the force which exists on the surface of liquids due to the attractions of the molecules. The force makes water assume spherical shapes in falling, as in raindrops. And, when liquids rise in fine capillary tubes, surface tension makes the upper surface form a curved shape called a meniscus.

If the attractive forces between the

molecules of the liquid are greater than the attractive forces between the liquid and the capillary tube, then the meniscus is rounded at the top and convex. Mercury behaves in this fashion.

If the attractive forces of the molecules for the glass in capillary tube are greater than the inter-molecular attraction, then the top of the meniscus is curved upward, higher at the edges than in the center. Water behaves in this fashion.

Dr. Langmuir's new report goes a step further and shows why not only a meniscus is formed but that in special cases, a thin layer of liquid lines the walls of the capillary tube and cuts down the effective diameter of the tube.

Science News Letter, December 24, 1938

ANTHROPOLOGY

American Types Seen as Needing Science Study

IT IS TRADITIONAL for scientific expeditions to go visiting savage tribes to study their unusual ways and customs. Perhaps the savages sometimes wonder whether foreign white men ever stay home to study their own unusual ways and customs.

It's an idea. It is something anthropologists are just beginning to do. And the United States, trying to assimilate the most extraordinary assortment of peoples in history, may well do it to advantage.

In Chicago, the Institute of Juvenile Delinquency has sponsored a study of how Mexicans and Negroes come into conflict with law and society. With over three million of its people rated as criminals, the United States is not being "academic" when it looks into racial and cultural backgrounds of crime.

A pleasanter duty for anthropologists is advocated by Dr. Vincenzo Petrullo, anthropologist and explorer. And that is to study valuable culture traits of immigrant groups, so that natural pride in ancestry may be used for good.

Before the Conference of Social Work, Dr. Petrullo said:

"I believe that the various immigrant

groups should never be made to feel that they have to discard and forget their cultural backgrounds and heritages in order to become good American citizens."

For the first time, Indians are being encouraged by the Office of Indian Affairs to keep their cultural personalities, so far as these fit modern life. Dr. Petrullo advocates the same chance for immigrant groups, who are mainly European with no such striking differences of culture as Indians represent. Eventually, he predicts, the foreign traits will blend into American culture or vanish. Scientific study, especially now that the government is actively engaging in such projects, may prove useful to see that those traits preserved are desirable.

Science News Letter, December 24, 1938

CHEMISTRY

Vitamin C May Be Formed From Fatty Substance

VITAMIN C, the substance in fresh fruits and vegetables which prevents and cures scurvy, belongs to the sugar and starch group of chemicals, but some detective work on its origins now shows that it is probably formed by plants and lower animals from a fatty substance.

Details of the investigation which gives new information on how this vitamin that scientists can produce in the laboratory is formed in life and on the novel chemical idea of a fatty substance like a lipid playing a part in the building up of a sugar are reported by Drs. Rade R. Musulin, Robert H. Tully, III, Herbert E. Longenecker and Charles Glen King (*Science*, Dec. 9).

Science News Letter, December 24, 1938

MEDICINE

Duty of State

● "I consider that it is the duty of the State to make the lives of the poor, and particularly of the mothers and children of the poor, as safe and healthy as possible. This, to the mind of all thinking persons, ought to be at least as important as the expenditure on safety against attack from warlike peoples." —George Sava in *THE HEALING KNIFE* (*Harcourt, Brace*).

Science News Letter, December 24, 1938

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gold ore was made in the Cimarron mining district of Nevada.

Quantity production of manganese ore was started in the Philippines.

Iridium, valuable rare metal, was discovered in Alaska.

A new floatation process was put into use, to "step up" the quality of coal.

A new process was developed for making use of low-grade bauxite in aluminum production.

Scientists who "camped out" on a floe near the North Pole, were rescued after their ice raft had drifted to the coast of Greenland.

Seven exploring expeditions were sent into the Arctic by the USSR.

More than 660 icebergs were observed in the North Atlantic, south of 48 degrees latitude, an unusually large number.

Balloon-borne meteorographs replaced airplanes for high-altitude weather observation at six U. S. Weather Bureau stations.

A submerged ancient river channel was discovered, cutting across the northern end of Lake Michigan.

Marine plants and animals were discovered to be concentrators of radium.

Old Faithful geyser in Yellowstone National Park staged a 115-minute-wait between eruptions, the longest on record.

Proof was found that Hawaii had an ice cap during the Ice Age.

The frozen carcass of a mammoth was found on Wrangel island.

Strange man-like footprints found in Kentucky rocks far too old to have known the tread of man, received the name *Phenanthropos mirabilis*.

A disastrous flood occurred in Los Angeles during the first week in March.

Great floods in China hampered the progress of the Japanese invaders during the summer.

The first promising source of platinum ore in the U. S. was discovered in Colorado.

Avalanches in the West Indian island of Santa Lucia caused large loss of life.

ENGINEERING—TECHNOLOGY

Television and Facsimile Come Out of Laboratory

THE YEAR 1938 will long be remembered by engineers and others as the year in which two revolutionary new forms of communication—television and radio facsimile, the transmission of printed matter and photographs by radio—made their first decisive steps out of the laboratory. Television receivers are now being offered for sale to the public. Facsimile broadcasting, first shown early in the year, is now under way from several stations throughout the United States.

Other noteworthy accomplishments were:

Fluorescent lamps, which are as much as 200 times as efficient as ordinary incandescent lamps and are cool to the touch, were introduced to the public.

Marked progress in utilizing the ultra short waves for television, local aeronautical and other radio purposes was made.

The Queen Elizabeth, with a gross register tonnage of 85,000 tons, the largest ocean liner in the world, was launched on the River Clyde.

Construction of the 108,000 kilovolt-ampere generators, the largest in the world, for Grand Coulee Dam was commenced.

Tiny radio transmitters for remote control of radio receivers were introduced into general use.

New "brighteners" marked a major advance in the art of silver plating, at the same time English scientists were finding a new way of preventing tarnish.

Grease containing radioactive material was pressed into service to locate flaws in metals.

"Flame scarfing"—removal of surface flaws with oxy-acetylene torches—was breaking up a serious bottleneck in steel production.

The world's largest, fastest wide-sheet strip mill for continuous production of steel was placed in service.

A clutchless automobile was successfully demonstrated in England.

A new transparent plastic proved an effective material for road-marking reflector buttons, an important advance in rural highway lighting.

MATHEMATICS

A New Type of Space Mathematics Introduced

MATHEMATICS as the queen and handmaiden of the sciences was pursued along many lines. Some of the outstanding developments were:

In the so-called four color problem, it was shown that any map on a sphere containing 31 or fewer regions can be colored with four colors.

The famous "Entscheidungs problem" concerned with finding a systematic method of deciding the truth or falsity of any given mathematico-logical statement, was considerably reduced by demonstration that only certain new normal forms of statements need be considered.

Advances were made in determining the significance of correlation coefficients obtained from data which are merely ranked instead of being quantitatively measured.

A new type of space, called uniform space, in which uniform continuity has sense, was introduced.

The existence of functions which minimize certain integrals under very extended types of conditions was established.

A new method was developed for resolving the singular points of a surface defined by algebraic equations.

Algebras in which multiplication is not commutative were studied actively.

MEDICAL SCIENCES

Health of Americans Was Better Than Ever Before

THE health of Americans was better than ever before, judging from the new low deathrate announced for the first 9 months of 1938, although a new health menace appeared with the discovery that the widespread "sleeping sickness" of horses, encephalomyelitis, caused deaths of several children; isolation of the horse disease virus from the brains of the children after death, constituted first proof that this horse disease, which may be carried by mosquitoes, wild birds and domestic fowl, could attack humans.

Chief events in the field of health and medicine were:

A National Health Conference considered a program for assuring adequate medical care to all the people.

A grand jury investigation of the American Medical Association and the Medical Society of the District of Columbia, was conducted to determine whether their activities constituted a violation of the anti-trust laws.

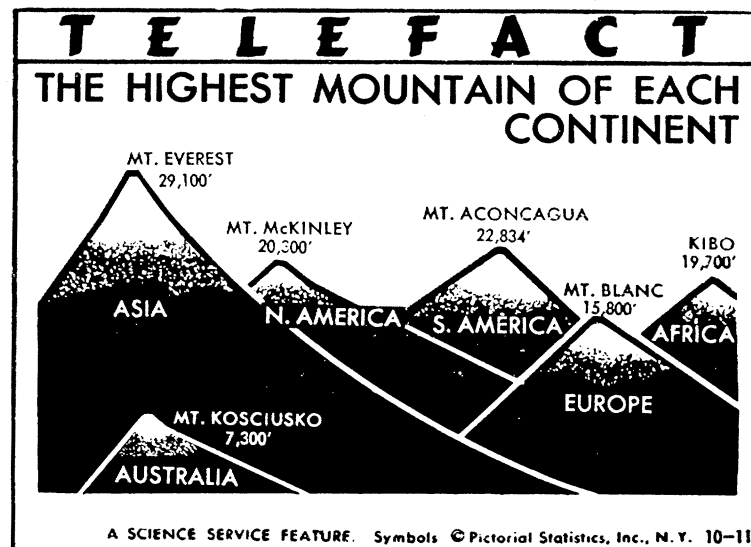
An antivivisection bill in California was defeated by a referendum vote.

The Nobel Prize in Medicine was not awarded for 1938.

An explanation of pseudohermaphroditism or intersexuality was given by experiments in which all male litters, containing some true males and some partially masculinized females, were produced by giving excessive doses of male sex hormone to pregnant rats, excessive doses of female sex hormone producing all female litters of true females and partially feminized males. For an exhibit of this research the American Medical Association's gold medal was awarded to the investigators: Drs. M. W. Burrill, R. R. Greene and A. C. Ivy of Northwestern University Medical School.

A newly discovered vitamin, K, when given with bile salts was found to decrease the tendency to bleeding in obstructive jaundice, and was isolated in crystalline form.

The fight against cancer was advanced by or-



ganization of the National Cancer Institute and of the National Advisory Cancer Council, and by research at Yale University under the Jane Coffin Childs Fund for Medical Research.

Prolonged injections of acetylcholine, chemical liberated into the body by the nervous system and believed the means by which nerves influence certain body activities, caused cancer in some animals, suggesting that one cause of cancer may be failure of the body to destroy this chemical rapidly enough.

Chemical vaccination against one type of cancer in mice was achieved in preliminary experiments by combining dibenzanthracene, potent cancer-causing chemical, with a protein.

Experiments with neutron rays from the cyclotron to treat human cancer sufferers were announced.

A new treatment for intestinal obstruction, injections of potassium, calcium and sodium salts and sugar, was announced.

Sulfanilamide and related chemicals continued to prove astoundingly effective in treating infectious diseases; Lymphogranuloma inguinale, undulant fever, staphylococcus infections, brain abscess, lobar pneumonia, trachoma, and distemper, canine counterpart of influenza, are the latest additions.

The fertility or anti-sterility vitamin E was synthesized as alpha tocopherol. This vitamin, in wheat germ oil, was reported to prevent habitual abortion in many cases in women. A mathematical formula for proper dosage of this vitamin for animals was worked out. Doubt was cast on the value of this vitamin for farm animals by reports that goats, rabbits and probably lambs can reproduce on a diet lacking vitamin E.

Massive doses of vitamin B appeared as a means of relieving pain in tic douloureux or facial neuralgia.

Acute neuritis of lepers was relieved by injections of vitamin B.

Value of nicotinic acid in treatment of pellagra was shown in a large number of cases.

Antibodies—germ fighters—for the infantile paralysis virus were discovered in cells of the nasal membranes of immune monkeys.

Injections under the skin of some strains of infantile paralysis virus were reported to cause the disease in large percentage of monkeys, thus indicating that the virus may not always enter the body through the nose and olfactory nerve and that preventive efforts, such as nasal sprays, based on this theory, may need revision.

Serum for treating Type III pneumonia became commercially available.

Arsphenamine, syphilis remedy, was found to kill the spirochetes of this disease in test tube experiments, suggesting that, contrary to previous belief, its curative action on syphilis is due to its spirocheticidal action.

For making the first isolation of a crystalline hormone from the anterior pituitary gland (the lactogenic hormone) Dr. Abraham White of Yale University was awarded a \$1,000 Eli Lilly and Company Award.

A close relationship between the function of the thymus gland and the proper development of the male sex glands was reaffirmed.

Secretion of the anterior-pituitary-like hormone of pregnancy of the placenta was apparently proved.

Discovery of the following new hormones was announced: the specific metabolic principle from the middle part of the pituitary gland; a liver hormone with power to check over-production of red blood cells; two new male sex hormones chemically related to one of the female hormones and to the cortical hormone of the adrenal glands.

Skin tanning was shown to depend, in part, upon male sex hormones.

Artificially radioactive substances were used to treat goiter and thyroid gland cancer.

A pyrethrum spray developed for war on New Jersey mosquitoes was found effective in combating the tsetse fly, carrier of deadly African sleeping sickness.

Cystine, a sulfur compound, was found to stimulate milk secretion in human as well as rat mothers.

Death or a faster life were shown to result from drinking heavy water (deuterium oxide) instead of ordinary water, depending on the amount of heavy water consumed.

Lactic acid formed in muscles during work was found to act only as a starter mechanism and not to be essential for continued muscle work, thus upsetting previous theories of lactic acid and muscle action.

Laboratory production of synthetic ephedrine was announced.

Local vaccination of the lining of the sinus was announced as a promising remedy for sinus disease, based on the presence of large numbers of the body's scavenger cells in the mucous membranes lining the sinuses.

Possibility of remedying or preventing some kinds of deafness in future by dietary means appeared from studies showing that deafness due to defect or disease of the auditory nerve may be due to faulty nutrition, especially lack of vitamins.

The prosthetic group of amino oxidase was isolated and shown to be a compound of riboflavin, a vitamin of the B complex, and of adenylic acid.

Successful development of a tiny radio tube for use in improved hearing aids for the deafened was announced.

PSYCHOLOGY—PSYCHIATRY

Experiments on Government Of Major Social Importance

OF MAJOR social importance were several studies of the psychological implications of government; democratic government by free debate and majority judgment was found in laboratory tests to result in output superior to that of the individual in creative and other types of intellectual work; the personality was also found to be strongly affected by the form of government, children becoming hostile, apathetic and vying for attention under dictatorial management, but thriving and happy under democratic self-government.

Other outstanding developments were:

A psychological test for picking out in advance those mental patients who can benefit from the new insulin shock treatment was reported.

Metrazol and insulin shock treatments continued to be used for large numbers of schizophrenics, statistical study in New York hospitals indicated that insulin increases amelioration 300 per cent.

Metrazol treatment, last year found to be helpful in schizophrenia, was found to have new uses; in shock doses it brought depressed mental patients back to sanity, in small doses it calmed excited patients, replacing sedatives.

Scientific analysis of the minute-long convul-

sions induced by metrazol treatment was made possible by use of slow motion pictures, throwing new light on epileptic seizures.

The successful use of thyroid hormone in the treatment of periodic catatonia was reported.

The discovery that a chemical substance like phenylhydantoin, which has no hypnotic activity, may be effective in controlling epileptic seizures opened a new therapeutic approach to this important medical problem.

The discovery that patients with dementia precox show disturbances in brain wave patterns which are altered in a similar way by various means (insulin hypoglycemia, metrazol convulsions, CO₂ inhalation, etc.) which are claimed to ameliorate this condition may give some insight into the development of this grave mental disease.

A theory explaining brain waves as electric impulses originating in the life processes of the brain cells was developed from records of the approach of death.

Brain waves were used successfully to supplement X-rays and other methods for diagnosis of cerebral tumors and scars and for locating such tumors prior to surgical operation.

Different patterns in the brain waves were found to distinguish persons with phobias, signs of paranoia or "queer ideas."

A research attack on the national problem of mental illness and its underlying social and economic causes was inaugurated by the U. S. Public Health Service with the cooperation of psychologists, psychiatrists and sociologists.

Mental and emotional as well as physiological improvement was noted in sexually deficient men, both young and old, following injections of the male hormone, testosterone propionate.

The imaginary voices heard by mental patients were found in about 20 per cent. of cases to have a possible real basis in a diseased condition of the ear.

A "fatigue service" was organized to aid in solving the emotional or personality problems of industrial workers.

Cured mental patients formed an association to influence public attitude toward mental disease.

Learning of the type known to psychologists as the conditioned reflex was apparently established in babies two months before their birth: forgetting and unlearning also was observed in the unborn.

Psychological testing of operated patients indicated that large portions of the brain's frontal lobes can be removed with little damage to the intelligence.

Neglect and a bad home may stunt the intelligence of children it was indicated by a study of 407 orphanage wards.

Positive evidence of how problem solutions are arrived at by a new combination of old memories known to psychologists as "direction" was discovered in experiments with rats.

Esthetic taste is strongly influenced by association and by acquired prejudices it was found in experiments during which objects of art and photographs of beautiful girls were shown associated with a good meal or with emotion-charged names.

Hearing for high tones develops earlier than hearing for low tones it was discovered in experiments on young opossums.

Chimpanzees were taught to operate food-vending machines requiring ability to distinguish colors on holders and release them in a certain order.

The Warren Medal in experimental psychology was awarded to Dr. Elmer Culler, University of Rochester.