SCIENTIFIC NOTES AND NEWS

DR. ALBERT EINSTEIN, who has been visiting the University of Oxford as a research student of Christ Church College, delivered the Herbert Spencer Lecture on June 10 on "The Method of Theoretical Physics." Dr. Einstein will lecture in Belgium during the summer vacation.

THE committee of the Paris Academy of Sciences has voted to present the name of Dr. Pieter Zeeman, professor of physics at the University of Amsterdam, for election to the academy.

THE Academy of Sciences at Heidelberg has elected to membership Dr. Ludwig Aschoff in pathology and Dr. Ernst Zermello and Dr. Gustav Doetsch in mathematics, all of the University of Freiburg.

THE degree of doctor of science was conferred at the commencement of Brown University on June 16 upon Dr. Niels Bohr, professor of physics in the University of Copenhagen, and upon Dr. Lipót Fejér, professor of mathematics at the University of Budapest. The address, made by Dr. Bohr, was entitled "Explanation in Natural Science." He also gave a lecture on "Measurements in Atomic Physics" at the convocation of the Graduate School.

THE Massachusetts State College has conferred the doctorate of science on Dr. Joseph B. Lindsey, who was a member of the staff of the Massachusetts Agricultural Experiment Station for forty-two years and vice-director for twenty-three years, and on Dr. Homer J. Wheeler, Upper Montclair, New Jersey, who was formerly director of the Rhode Island Experiment Station.

WASHINGTON COLLEGE, of Chestertown, Maryland, has conferred the degree of doctor of laws on Dr. Howard A. Kelly, emeritus professor of gynecology at the Johns Hopkins University.

THE degree of doctor of science was conferred at the commencement of Ursinus College on Dr. Guilliam H. Clamer, of Philadelphia, known for his contributions to non-ferrous metallurgy and for his development of electric furnaces.

THE University of Sheffield has conferred the doctorate of science on Professor E. J. Garwood, of the University of London, past-president of the Geological Society of London, and on Professor J. B. Leathes, dean of the Faculty of Medicine of the university.

AT the annual banquet of the Minnesota Chapter of Sigma Xi, held on June 7, the chapter presented to Dr. William J. Mayo, of the Mayo Foundation, Rochester, and to Dean Guy Stanton Ford, dean of the Graduate School of the University of Minnesota, illuminated testimonials in recognition of their service in furthering science and scientific research in Minnesota. The awards were presented by Dr. Louis B. Wilson, national president of Sigma Xi.

THE Distinguished Flying Cross, posthumously awarded to Glenn Hammond Curtiss "for outstanding service rendered to aviation" has been presented to Mrs. Lua Andrews Curtiss, his mother. The presentation was made by Major General Benjamin D. Foulois, chief of the U. S. Army Air Service, at the aviation base at Chapman's Field, Miami.

DR. ALFRED PHILIPPSON, professor of geography at Bonn, and Dr. Erich von Drygalski, professor of geography at Munich, have been awarded Richthofen gold medals. Dr. Ernst Tiessen, professor of geography at Berlin, has received the silver medal.

THE nomination of Dr. Lyman J. Briggs as director of the Bureau of Standards has been confirmed by the Senate.

DR. DUDLEY S. CONLEY, professor of surgery in the School of Medicine of the University of Missouri, will succeed Dean Edgar Allen, who recently resigned to become professor of anatomy and head of the department of anatomy at Yale University.

DR. CHARLES ZELENY, professor of zoology, University of Illinois, has been appointed head of the department to succeed Dr. Henry B. Ward, who has become permanent secretary of the American Association for the Advancement of Science under conditions which permit him to continue research work.

CHARLES JUDSON HERRICK, professor of neurology in the department of anatomy at the University of Chicago since 1907, has been appointed chairman of the department. He succeeds Dr. Robert R. Bensley, who retires with the title of professor emeritus. Dr. Bensley, who went to the university in 1901 as assistant professor of anatomy, has been professor since 1907 and chairman of the department since 1913. He will offer graduate work in the department next year.

CHARLES E. JACKSON has been appointed by President Roosevelt Deputy Commissioner of Fisheries. Since November, 1922, Mr. Jackson has been with Senator E. D. Smith, serving in the capacity of secretary. He succeeds Dr. Lewis Radcliffe, who resigned on April 30, after twenty-six years service with the bureau.

PROFESSOR JUNIUS HENDERSON, of the University of Colorado, curator of the museum since 1903, has retired at the age of sixty-eight years. He was given a farewell banquet by the informal senate of the university, when speeches were made by the vice-presi-

dent, the dean of the graduate school and heads of various departments. Dr. Henderson plans to spend a year in California. He is succeeded by Hugo G. Rodeck, who will hold the academic rank of assistant professor.

AT the University of Bristol Dr. J. F. Baker, technical officer to the British Steel Structures Committee, has accepted an invitation to fill the chair of civil engineering in succession to Professor A. J. S. Pippard, who resigns at the end of the current session, and Professor A. E. Trueman, professor of geology at University College, Swansea, has been appointed Chaning Wills professor of geology in succession to Professor S. H. Reynolds, who retires at the end of the year.

DR. ALEXIS CARREL, of the Rockefeller Institute for Medical Research, sailed for France on June 10.

DR. JOHN C. MERRIAM, president of the Carnegie Institution of Washington, gave the commencement address on June 12 at the Carnegie Institute of Technology, Pittsburgh.

THE first public meeting of the new chapter of Sigma Xi in the University of California at Los Angeles was addressed on May 24 by Professor Niels Bohr on "Space-Time Relations in Atomic Physics."

DR. HERBERT DINGLE, professor of astrophysics in the Imperial College of Science and Technology, London, and research fellow in the California Institute of Technology, 1932–33, on June 7 lectured on "The Nature of Scientific Thought" at the University of California at Los Angeles, under the auspices of the department of astronomy.

SIR HENRY HADOW gave the Romanes lecture for 1933 at the University of Oxford, on May 31. The title of the lecture was "The Place of Music among the Arts."

PROFESSOR OTTO HAHN, the George T. Baker nonresident lecturer in chemistry at Cornell University during the spring semester, delivered three lectures at the University of Minnesota on June 5, 6 and 7—before the Minnesota Section of the American Chemical Society on "Gaseous Radioelements and their Application in Chemical Research," before the Colloquium of the School of Chemistry on "Co-precipitation and Adsorption Processes" and before the annual meeting of Sigma Xi on "From the Ponderable to the Imponderable." Professor Jan Heyrovsky, of the Charles University of Prague, gave three lectures before the colloquium on the "Theory and Practise of the Polarigraphic Method" on June 8, 9 and 10.

THE *Journal* of the American Medical Association reports that the Gorgas Medical Society of New Orleans has awarded honorary fellowships as follows: to Dr. Arthur Vidrine for his work in surgery; to Dr. Joseph Rigney D'Aunoy for his work on electrocardiography and to Dr. Richard Ashman for achievement in research. The awards are made to those "who have distinguished themselves in medical science and research." Dr. Vidrine is dean of the medical center of the University of Louisiana, Dr. D'Aunoy is professor of pathology and bacteriology and executive secretary of the center and Dr. Ashman is professor of physiology. These fellowships are the first to be awarded by this society, which was organized last year by Dr. Clyde Brooks, professor of pharmacology and experimental therapeutics.

THE twenty-first Wilbur Wright memorial lecture was read by Colonel F. P. Lahm, Air Corps, U. S. Army, on May 30, before the Royal Aeronautical Society at its meeting held in the Royal Institution. Before the lecture the following medals were presented by the president, C. R. Fairey: the gold medal of the society, to Sir Richard Glazebrook, on his retirement from the chairmanship of the Aeronautical Research Committee, which he has held since the foundation of the committee in 1909; the Simms Gold Medal, for the best paper read before the society on any science allied to aeronautics, to Mr. P. Salmon, for his paper on catapults; the Wakefield Gold Medal, for inventions or apparatus tending towards safety in flying, to Mr. L. G. Frise, for his invention of the Frise aileron; the Taylor Gold Medal, for the most valuable paper of the year, to Dr. G. V. Lachmann, for his paper on "Control beyond the Stall"; the Silver Medal, for advance in aeronautical design, to each of the following: Señor J. de la Cierva, for his work in the design and development of the autogiro; Mr. A. H. R. Fedden, for his work on the air-cooled engine, resulting in the attainment of a record height of over 40,000 feet in September, 1932; Mr. D. L. Hollis-Williams, who was responsible for the design of the Fairey long-range monoplane which holds the world's long-distance record of 5,309 miles. The newly-founded British Silver Medal for Aeronautics, to Flight Lieutenant C. F. Uwins, for reaching the world record height in September last, and to Squadron Leader O. R. Gayford and Flight Lieutenant G. E. Nicholetts, who flew non-stop from Cranwell to Walvis Bay in the long-distance monoplane.

ACCORDING to the *Journal* of the American Medical Association, at the general meeting of the Imperial Academy of Japan, the special committee announced the awards of the imperial prizes and others for 1932. The imperial prizes were given to Dr. J. Tsuji, of the Physical and Chemical Research Institute, for his researches on the elasticity of light, and to Professor B. Suzuki, D.Sc., of the Kyoto Imperial University, for his work on fatty acids. The academy

prize was awarded to Professor M. Ishimoto, of the Tokyo Imperial University science department, for his seismological observations. The emperor's wedding commemoration prizes, contributed by the Osaka *Mainichi,* were given to Professor S. Kusano, of the Tokyo Imperial University, for his work on fungi; to Professor C. Oguchi, of the Nagoya Medical College, for his research on Oguchi's disease, to Professor Y. Furutake, of the Osaka Imperial University, for his discovery of kynurenin, a crystal chemical compound, and to Professor H. Nomura, of the Sendai University, for his study on the pungency of ginger.

ACCORDING to the *Astronomische Nachrichten,* the division of the Astrophysical Observatory in Potsdam that has been called the Einstein Institute will by decree of the ministry be hereafter known as the Institute for Solar Physics.

ANNOUNCEMENT has just been made at Harvard University that the Institute of Geographical Exploration has been given a valuable library collection which includes several rare accounts of early voyages of exploration and discovery in America. The collection is stated to be the most important single addition which has yet been made to the library on geographical exploration. Numbering nearly 1,000 separate items, the collection has been presented to the university by Mrs. Joseph Tuckerman Tower, of Millbrook, New York. It includes principally books, maps and documents which were collected by her son, Joseph Tuckerman Tower, Jr., of the Harvard College Class of 1921, who died in Mexico in 1931. Before his death Mr. Tower had planned the gift of his collection to the institute at Harvard. In addition to many rare and valuable old books on early voyages, the library includes sections dealing with Arctic exploration, exploration in Alaska, Iceland and in the Hudson Bay region.

THE Board of Governors of the Institute of Medicine of Chicago recently authorized an appropriation of $1,455 to compile a combined card catalogue of the literature in the medical libraries of Chicago (John Crerar, Rush Medical College and the medical colleges of the universities of Chicago, Illinois, Loyola and Northwestern). The plan was organized and the work is being carried out under the supervision of Otto F. Kampmeier, professor of anatomy at the University of Illinois, and chairman of the committee on coordination of medical libraries in Chicago. The union index will be completed in six to eight months, and will be placed in the John Crerar Library because of its central location in the city.

AN additional one hundred and ninety acres of marsh and prairie land have been added to the University of Wisconsin arboretum. Funds made available by the Tripp estate have made acquisition of this land possible. The new tract adjoins the present arboretum land on the south and west, and increases the total area of the arboretum to slightly more than 400 acres. Addition of the new area to the present arboretum gives the university and the State of Wisconsin an excellent opportunity for experimentation in reforestation and propagation of wild life. Acquisition of several tracts deemed essential to the project permitted the Board of Regents to establish the Wisconsin arboretum last August, after nearly six years of constant work on the part of regents, university officials and public-spirited Wisconsin citizens. No state appropriated funds whatever have been used on the project. Acquisition of the original tract of 235 acres was also made possible through use of the residue of the estate of the late J. Stephens Tripp, who left his entire estate to the university. Other groups of citizens donated land also. The committee in charge of the arboretum consists of Professors E. M. Gilbert, George Wagner, James G. Dickson, Chancey Juday, N. C. Fassett, Leon J. Cole and J. W. Jackson, Associate Franz A. Aust, Instructor F. B. Trenk, Superintendent A. F. Gallistel, Secretary M. E. McCaffrey. In addition to this active committee the president has appointed an advisory committee consisting of Dr. E. A. Birge, Dr. H. L. Russell, C. P. Winslow, Aldo Leopold, Paul D. Holleter and Professor Raphael Zon.

THE thirty-seventh annual report has been issued of the New York Zoological Society, which maintains the Zoological Park in the Bronx, the Aquarium and the tropical research station. The report of finances states that the City of New York appropriated $418,891 toward the maintenance of the Zoological Garden and the Aquarium during 1932. During the year the society expended $227,730. The endowment and other funds are $4,123,637, of which $4,035,386 is represented by securities carried at cost or gift value. The market value on December 31 was $3,157,173. "For the continuation of its work," according to the report, "the society requires the immediate addition of $2,000,000 to its general endowment, and desires the constant attention of its members and friends to the needs of its library, extension of its scientific research work, heads and horns collection, publications and gallery of animal paintings."

AS the result of a proposal made by Dr. Schaffernak, of Austria, at the World Power Conference at Berlin in 1930, that "an organization be established for the purpose of interchanging, in the field of hydraulic engineering, the results of laboratory research and of observations of natural conditions corresponding thereto," the American committee of the World Power Conference asked the Bureau of Standards last January to serve as the exchange agency for the

United States. The object of the proposed organization is to afford promptly to all the hydraulic laboratories throughout the world information as to the nature of the research which each is undertaking, thus permitting a closer coordination of the work. The first step in organizing this service nationally in the United States was to compile and distribute to the hydraulic laboratories in this country a report covering the activities of these laboratories. As a result of the prompt cooperation of the individual laboratories, it was possible for the bureau to issue on April 1 its first report of this kind, a mimeographed bulletin entitled, "Current Hydraulic Laboratory Research in the United States." The second report will be issued on July 1, and succeeding numbers will appear quarterly. In addition to the above service, the bureau will compile and issue annually a description of the hydraulic laboratories in the United States, their equipment and facilities for research in so far as the heads of the laboratories will furnish the necessary information. It is planned to issue the first report of this kind on June 1.

DISCUSSION

AN ELECTRIC ANALOGUE OF VOWEL PRODUCTION

IT is of interest to examine the results of the remarkable if somewhat bizarre experiment of Travis and Buchanan,[1] which relates to the production of sound frequencies in the voice, in the light of our knowledge of analogous electric circuit behavior. The mathematics of the electric circuit is remarkably well developed, and since in many cases a strict analogy may be demonstrated between sound vibrations and electric vibrations, it is hoped that in the present study a consideration of this mathematics will prove significant.

First, the possible appearance in the output of vibration frequencies that are entirely absent in the motive force should be considered, that is, the appearance of frequencies in the voice that would not appear in the vibration of vocal cords in the open. Or, in terms of this particular experiment, the change of wave-form when a pure sine wave is passed into the resonating cavities.

There is no doubt that such a change is possible. It is the result of non-linear response of some of the elements involved in the propagation of sound, and appears when a strictly sinusoidal stress does not result in a strictly sinusoidal strain in either the vibrating medium or the containing walls. The irregularity of the vocal passage and the non-homogeneity of the walls make a somewhat non-linear response certain, but the amount of the change of wave-shape is unknown. The amount of the change at any one point may be small, but if any of the chief frequencies thereby introduced should find a resonating cavity of the same natural frequency, the amplitude of such frequency will be greatly increased. It should also be noted that the vibration of the vocal cords is not entirely independent of the resonant system in which they operate, although for practical purposes it is very nearly so. It is to be expected that the distortion of loud sounds is greater than that of soft ones.

[1] SCIENCE, 77: 121, January 27, 1933.

Second, the magnification, in the output, of small irregularities in the input must be considered. An abrupt change in the input motion, a discontinuity, will produce resonance in all cavities, but in amounts varying with the natural frequency, location and size of the cavity. An irregular, or non-sinusoidal input will have a similar effect. So will a wave whose steady-state condition is sinusoidal, when it is starting or stopping. All three of these means of producing resonance will doubtless occur in the normal voice. Only the second will be appreciable in the experiment, as described, with the oscillator; but it is evident that the input can not be mathematically exact even under the most favorable experimental conditions, and there is no mention of a determination of the exact wave-form in detail.

Finally, the relative amounts of frequencies introduced by the two means should be considered. The first, the distortion due to non-linear response of the vocal passages, can produce energy of one frequency only at the expense of decreasing energy of another frequency. The more audible a frequency is, the more it is being damped by losing energy as output. From these considerations, and from the nature of the system, it is improbable that resonance in the sinusoidal steady-state condition could introduce frequencies with amplitudes of more than a few per cent. of the fundamental.

The second type of distortion, due to transient conditions or to non-sinusoidal input, will give resonant vibrations that depend for their energy on a component vibration of their own frequency in the input. Hence, as they also are damped by the output, their amplitude with an approximate sine-wave input may be of the same order of magnitude as the steady state distortion.

So both "steady-state" and "transient" production of resonant frequencies appear to be possible. In either case a small amplitude may be magnified to many times its original amount by resonance, and from the published data it seems impossible to tell