physics at Pennsylvania State College in 1929, Dr. Whitmore was instructor in organic chemistry at Williams College and at Rice Institute, assistant professor at the University of Minnesota and professor and head of the chemistry department at Northwestern University.

He is consultant and member of the Scientific Advisory Committee of the Chemical Warfare Service. He has held many offices in the American Chemical Society, starting with the treasurership of the Southeast Texas Section in 1917, and including nine years of service as a national director and eight years as secretary and chairman of the Division of Organic Chemistry. He was a vice-president of the American Association for the Advancement of Science in 1932. He has also been chairman of the Division of Chemistry and Chemical Technology of the National Research Council and a member of other divisions of that organization.

AWARD OF THE CHARLES FREDERICK CHANDLER MEDAL

THE sixteenth award of the Charles Frederick Chandler Medal of Columbia University has been made for 1936, the centennial of Chandler's birth, to Dr. John Howard Northrop, of the Rockefeller Institute for Medical Research. Dr. Northrop, who will deliver the annual Chandler lecture next spring, was cited for fundamental discoveries concerning bacteria, the constitution of protein and the chemistry of digestion.

The medal was founded in 1910 to honor Chandler, called the father of the American Chemical Society, who was born on December 6, 1836, and who, for more than half a century, accomplished pioneer work in industrial chemistry, advanced public health and directed the teaching of chemistry at Columbia.

Dr. Northrop received the degree of bachelor of science from Columbia in 1912, the master of arts in 1913 and the doctorate in 1915. He held the William Bayard Cutting Travelling Fellowship in 1915–16. He has been associated with the Rockefeller Institute since 1916, becoming a member in 1924. During 1918–1919 he served as captain in the Chemical Warfare Service. He is a member of the editorial board of the *Journal of General Physiology* and of the National Academy of Sciences. He received the Stevens Prize of the College of Physicians and Surgeons in 1931, and Harvard University conferred upon him the honorary degree of doctor of science during the Tercentenary Celebration last September.

Previous recipients of the Chandler Medal include Leo H. Baekeland, William A. Hillebrand, Willis R. Whitney, F. G. Hopkins, Edgar R. Smith, R. E. Swain, E. C. Kendall, Samuel W. Parr, Moses Gomberg, John Arthur Wilson, Irving Langmuir, James Bryant Conant, George O. Curme, Jr., Jacob Goodale Lipman and William F. Giauque.

Besides Professor Thomas, Professer Leo H. Baekeland and Professor Arthur W. Hixson are members of the Chandler Lectureship Committee.

In making public the award Dr. Butler said in part:

> Columbia University could not let the one hundredth anniversary of the birth of Professor Charles Frederick Chandler go without recognition and grateful acknowledgment of his outstanding scientific and university service.
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> In 1864 Chandler came to Columbia as one of the group which planned the establishment of the famous School of Mines, the first of its kind in the United States. His associates were Professor Thomas Egleston and General Francis Laurens Vinton. From that time he remained at the head of the department of chemistry at Columbia until his retirement in 1911. His eager and many-sided personality led him into various forms of public service, in each of which he distinguished himself.
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> He was dean and executive officer of the School of Mines for a third of a century, and in addition taught chemistry to the students of medicine at the College of Physicians and Surgeons, and served as Health Officer of the City of New York. He built many monuments, some of them visible and some invisible, but all of an excellence and a distinction which have made his name a memorable one.
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> Columbia University, in its every part, held his personality in warm affection and will always hold his memory in highest honor and gratitude.

SCIENTIFIC NOTES AND NEWS

DR. AMBROSE SWASEY, the distinguished mechanical engineer, chairman of the board of directors of Warner and Swasey, Cleveland, Ohio, celebrated his ninetieth birthday on December 19.

BRIGADIER-GENERAL DAVID LEGGE BRAINARD, retired, known for his Arctic explorations, celebrated his eightieth birthday on December 21.

LEADERS in military and civil aviation, including members of the National Advisory Committee for Aeronautics, honored Wilbur Wright and Orville Wright on the thirty-third anniversary of the first flight by Orville Wright at Kittyhawk, N. C., on December 17, 1903. A wreath was placed on the grave of Wilbur Wright, and personal greetings, including a message from President Roosevelt, were presented to Orville Wright at his home. Those present included Dr. Joseph S. Ames, chairman of the National Advisory Committee for Aeronautics, and Dr. Charles G. Abbot, secretary of the Smithsonian Institution.

THE Laveran Gold Medal of the Société de Pathologie Exotique of Paris has been conferred upon Dr. A. W. Sellards, associate professor of tropical medicine at the Harvard University Medical School. Dr. Sellards has been associated with French investigators in the study of yellow fever since 1927. This work has culminated in the development of an effective vaccine which has now been employed for the protection of more than 20,000 persons.

A CORRESPONDENT writes: "In recognition of the long and unusually productive career of Dr. George A. Campbell in telecommunication, it has been decided to reprint his more important scientific and engineering papers in a commemorative volume. Dr. Campbell retired recently from active service as research engineer of the American Telephone and Telegraph Company. Among his contributions are the electric wave-filter, the anti-sidetone telephone circuit and the four-wire repeater circuit. The volume of collected papers is being printed privately by the American Telephone and Telegraph Company, and distribution will be handled through the editorial office of the *Bell System Technical Journal*."

AT a meeting of the Rittenhouse Astronomical Society of Philadelphia, held on December 11 at the Franklin Institute, honorary membership was conferred upon Robert R. McMath, director of the McMath-Hulbert Observatory of the University of Michigan, in recognition of his contributions to astronomy through the medium of motion pictures. Mr. McMath then spoke to the society on his work and showed his latest motion pictures of solar prominences.

DR. ALEXANDER WETMORE, assistant secretary of the Smithsonian Institution, has been designated correspondent of the Museum of La Plata.

THE annual distinguished service medal of the American Farm Bureau has been awarded jointly to Senator George W. Norris, of Nebraska, and Henry A. Wallace, Secretary of Agriculture.

THE Massachusetts Horticultural Society has awarded its gold medal to Norman Taylor, formerly curator of plants at the Brooklyn Botanical Garden, with the citation, "For your work in editing 'The Garden Dictionary,' considered to be the most notable horticultural book which has appeared in America in recent years."

A BANQUET was given on December 12 in honor of Dr. Guy Y. Williams, head of the department of chemistry at the University of Oklahoma, in recognition of his thirty years of service to the university. Members of Alpha Chi Sigma and the American Institute of Chemical Engineers sponsored the tribute; students, faculty members and alumni attended the banquet.

THE Board of Canvassers of the American Pharmaceutical Association, composed of Edward Spease, *chairman;* Edward D. Davy, and F. J. Bacon, all of Cleveland, Ohio, has announced, as the result of the mail ballot for the officers of the association, the election of the following: *President Elect,* E. N. Gathercoal, Chicago; *First Vice-President Elect,* W. Mac Childs, Eldorado, Kansas; *Second Vice-President Elect,* Glenn L. Jenkins, Minneapolis; *Members Elect of the Council,* H. A. B. Dunning, Baltimore; S. L. Hilton, Washington, D. C., and P. H. Costello, Cooperstown, N. Dak.

OFFICERS of the Rittenhouse Astronomical Society of Philadelphia have been elected as follows: W. Herbert Fulweiler, of Wallingford, Pa., *president;* Dr. John H. Pitman, of the Sproul Observatory, *vice-president.* A. Clyde Schock and Sigurd W. Johnson were reelected secretary and treasurer, respectively. James Stokley, associate director of the Franklin Institute, in charge of astronomy, was elected a member of the Board of Governors.

DR. JOHN W. GOWEN, research geneticist at the Rockefeller Institute for Medical Research at Princeton for the past ten years, has been appointed professor of genetics at the Iowa State College.

FRANCIS SCHUMACHER, senior silviculturist and chief of the section of forest measurements in the United States Forest Service since 1930, has been appointed professor of forestry at Duke University, effective on July 1.

JOHN W. THOMPSON, assistant physician at the Royal Hospital, Edinburgh, Scotland, formerly lecturer in physiology at Swarthmore College and demonstrator in physiology at the University of Edinburgh, has been appointed an assistant in the Harvard Fatigue Laboratory for the remainder of the academic year.

DR. LAWRENCE WADE BASS has been appointed a member of the executive staff of Mellon Institute of Industrial Research. He served as executive assistant at Mellon Institute from 1929 to 1931 and is returning to that organization as assistant director after having been connected with the Borden Company, New York, as director of research. He will assume his work at the institute on January 1.

THE Engineering Foundation, with the sponsorship of the American Institute of Electrical Engineers, has appropriated $5,000 for experimental research on the "Stability of Impregnated Paper Insulation." The work is to be done in the School of Engineering of the Johns Hopkins University under the direction of Dr. J. B. Whitehead, professor of electrical engi-

neering. It is expected that the present program will be extended through a second year.

THE trustees appointed under the trust set up by Lord Nuffield to administer his gift of £2,000,000 for medical research at the University of Oxford are W. M. Goodenough, who will act as chairman (appointed by Lord Nuffield); the vice-chancellor (*ex-officio*); Sir Farquhar Buzzard, Professor Johnston and R. W. Thornton (appointed by Lord Nuffield); the registrar of the university (appointed by the Hebdomadal Council); Dr. Edward Mellanby (appointed by the board of the Faculty of Medicine); Andrew Walsh and Major R. C. Rowell (appointed by the Radcliff Infirmary), and A. H. Wood (appointed by the Wingfield Morris Orthopedic Hospital).

THE Laboratory of Industrial Hygiene has been incorporated under the laws of the State of New York as a non-profit organization empowered to carry on scientific and industrial work in chemical, bacteriological and, in general, public health problems, to accept grants for definite scientific purposes, etc. Its officers include Dr. William Hallock Park, *president;* Miss Grace McGuire, *secretary,* and Dr. K. George Falk, *vice-president and treasurer.* Its staff includes Miss Grace McGuire, in charge of chemical work; Mrs. Eugenia Valentine Colwell, in charge of bacteriological work; Dr. K. George Falk, director; Dr. William Hallock Park, consultant, and a number of assistants. The laboratory includes at the present time the following units: (1) Certified Milk Laboratory under the direct supervision of Dr. Park; (2) Vitamin Testing Laboratory; (3) Clinical Diagnostic Laboratory; (4) Chemical Laboratory, and (5) Bacteriological Laboratory.

ARRANGEMENTS have been concluded with Dr. Isaiah Bowman, president of the Johns Hopkins University and fellow of the Geological Society of America, for an address to be given at the annual dinner of the society on December 30. Because of the inability to engage broadcasting facilities at that time, it has been arranged for Dr. Bowman to give his address to the larger audience of the air on Wednesday afternoon from 2:00 to 2:15 (E. S. T.) over Station WLW. His subject is to be "Geology in the Evolution of Culture."

DR. C. E. KENNETH MEES, director of research of the Eastman Kodak Company, delivered the first John Howard Appleton lecture for the year 1936–37 in the Metcalf Auditorium, Brown University, on Friday evening, December 18. His subject was "Color Photography." The lecture was illustrated by colored lantern slides and color movies.

THE third lecture in the Smith-Reed-Russell series for this year at the School of Medicine, the George Washington University, was given on December 15 by Dr. Thomas Parran, Jr., Surgeon General, U. S. Public Health Service, who spoke on "The Enlarging Opportunities for a Career in Public Health."

DR. BENO GUTENBERG, professor of geophysics and meteorology in the California Institute of Technology, gave an illustrated lecture on "Earthquakes" before the Chapter of the Society of the Sigma Xi of the University of California at Los Angeles on December 2.

PROFESSOR TULLIO LEVI-CIVITA, of the University of Rome, gave a lecture on December 3 on "A New Deal for the Elementary Foundations of Relativity," before the Mathematics Club, conducted jointly by the departments of mathematics of Bryn Mawr College, Haverford College, Swarthmore College and the University of Pennsylvania.

LORD RUTHERFORD and Lord Horder were the speakers at the opening of the Mozelle Sassoon high voltage x-ray therapy department of St. Bartholomew's Hospital, London, on December 10.

THE first International Conference on Fever Therapy will hold its sessions on March 29, 30 and 31, 1937, at the College of Physicians and Surgeons, Columbia University, New York City. The first day will be devoted to the discussion of physiology, pathology and methods of production of fever. Dr. Frank W. Hartman, Henry Ford Hospital, Detroit, Michigan, is chairman of the committee arranging this section of the program, and Dr. Charles A. Doan, of Ohio State University, is secretary. The second day is to be spent in the consideration of miscellaneous diseases treated by fever, such as chorea, rheumatic carditis, ocular diseases, arthritis, leprosy, meningococcus infections, undulant fever, tuberculosis, tumors, skin diseases, etc. This session will be arranged by Dr. Clarence A. Neymann, of Chicago, with the assistance of Dr. Frank H. Krusen, of the Mayo Clinic, as secretary. The morning of the third day is to be devoted to the consideration of syphilis. Dr. Walter M. Simpson, Miami Valley Hospital, Dayton, Ohio, is chairman of this section, which has as its secretary Dr. Leland E. Hinsie, New York State Psychiatric Institute, New York City. In the afternoon of the same day, the treatment of gonorrhea by fever is to be discussed under the chairmanship of Dr. Stafford L. Warren, Strong Memorial Hospital, University of Rochester, Rochester, N. Y. The secretary of this committee is Dr. Charles M. Carpenter, Rochester, N. Y. Baron Henri de Rothschild, of Paris, is general chairman of the International Conference on Fever Therapy. Dr. Walter M. Simpson, Dayton, Ohio, is chairman of the American committee. All who plan to attend the conference are urged to register

promptly with the general secretary, Dr. William Bierman, 471 Park Avenue, New York City. The registration fee is $15.00.

THE post-doctorate fellowships in the biological sciences (zoology, botany, anthropology, psychology, agriculture and forestry), available through the National Research Council for the academic year 1937–38, will be awarded by the Board of National Research Fellowships in the Biological Sciences at a meeting which is to be held the latter part of April. Applications should be filed with the office of the board by February 15, 1937. Appointments may be made prior to the conferring of the doctor's degree, to be effective upon the receipt of the degree within six months. Application blanks and statement of conditions will be furnished upon request by the secretary, Board of National Research Fellowships in the Biological Sciences, National Research Council, Washington, D. C.

THE Committee on Scientific Research of the American Medical Association invites applications for grants of money to aid in research on problems bearing more or less directly on clinical medicine. Preference is given to requests for moderate amounts to meet specific needs. For application forms and further information, the committee should be addressed at 535 North Dearborn Street, Chicago, Illinois.

NEW premises for the research laboratories of the British Institution of Automobile Engineers have been acquired on the Great West Road, Brentford, near the Firestone factory. According to the London *Times*, the front of the building is imposing, the two-story block housing the general offices, library and committee room, while at the rear there are sections for physical and chemical testing of materials, a bay for testing complete vehicles and another for the simultaneous testing of as many as eight engines. Beyond a car park there is a further building containing the stores, workshop and another bay where several independent researches can be undertaken. The premises are now being fitted out, and it is hoped that they will be opened in the early spring. Most of the investigations sponsored by the institution have been carried out at the Chiswick laboratories, which consist of a large private house with a workshop at the rear. These premises have served their purpose well, but it became obvious during the past year that a move would have to be made to more modern premises. The rapid development of the institution's research activities is illustrated by the fact that four years ago there was only one item on the program of research, whereas now there are ten. During the same period the number of manufactures and vehicle operators affiliated to the institution has increased from 28 to 180.

DISCUSSION

SIGNIFICANT FIGURES IN STATISTICAL CONSTANTS

PROFESSOR JOSEPH BERKSON'S discussion, under the above heading, in the November 13 number of SCIENCE pertains to a subject with respect to which there has been a great deal of misunderstanding. More than twenty years ago, however, I published a paper (in the *American Mathematical Monthly*, 1913, vol. 20, p. 242) in which I explained in detail the reason for the properties of the solutions of linear equations which Professor Berkson notes. Since my paper is not now readily accessible to many who may be interested in the subject, I will repeat its conclusions, without entering into proofs.

In order to make my statements as concrete as possible, I will relate them to the linear equations

$$a_1x + b_1y + c_1z = n_1,$$
$$a_2x + b_2y + c_2z = n_2,$$
$$a_3x + b_3y + c_3z = n_3,$$

in which a_1, b_1, . . . etc., and n_1, n_2, and n_3 are given numbers, and from which x, y and z are to be determined. In practical problems the coefficients a_1, b_1, . . . etc., and the right members n_1, n_2 and n_3 will be known approximately; that is, to some number of significant figures. For the purpose of illustration here, it will be assumed that they are all given to six significant figures.

There are two questions to be answered: (1) Are x, y and z determined by the equations, and if so, (2) to how many significant figures? The answer to the first question is given in every algebra. It is: The equations have a solution, and only one, for x, y and z if the determinant of the coefficients a_1, b_1, . . . etc., is not zero. (If the determinant is zero, at least one of the quantities x, y, z may be assigned an arbitrary finite value.)

The answer to the second question is that the number of significant figures in the solution for x, y, z can not exceed the number of significant figures in the determinant of the coefficients a_1, b_1, . . . ,but usually equals the number of significant figures in the determinant. To illustrate, suppose the determinant of the coefficients of the given equations has only three determined significant figures. Then, although the coefficients a_1, b_1, . . . and the right members n_1, n_2, n_3 are all given to six significant figures, the values of x, y and z are not determined by the equations beyond three significant figures, and the retaining of a large number of places in the calculations can not improve the results.

Perhaps it is advisable to make a few comments on