to William H. Phillips, head of the stability and control flight section at Langley Field.

A number of fellowships and honorary memberships in the institute were conferred.

AWARD OF THE GOLD MEDAL OF THE AMERICAN INSTITUTE OF CHEMISTS

THE gold medal of the American Institute of Chemists, presented annually for "noteworthy and outstanding service to the science of chemistry or the profession of chemist in America," was awarded on February 2 to John W. Thomas, chairman and director of the Firestone Tire and Rubber Company. The medal was given in recognition of his leadership in rubber research for four decades and for achievements under his direction in the development and production of synthetic rubber.

Former recipients of the medal include Dr. Willard H. Dow, president of the Dow Chemical Company; Andrew W. Mellon, the late Secretary of the Treasury, and his brother, the late Richard B. Mellon, of Pittsburgh; James Bryant Conant, president of Harvard University, and the late George Eastman, founder of the Eastman Kodak Company.

Formal presentation of the medal will be made on May 11 at Columbus, Ohio, during the twenty-third annual meeting of the institute. The chairman of the committee arranging the conference is E. L. Luáces, president of the Chemical Developments Corporation, Dayton, Ohio, and chairman of the Miami Valley Chapter of the institute. Dr. James R. Withrow, head of the department of chemical engineering of the Ohio State University, is honorary chairman.

During the last year, Mr. Thomas has supervised the designing and construction of a $2,000,000 rubber research laboratory which is one of the most modern and complete in the world. This laboratory will be dedicated within the next few months.

The jury of chemists making the award was composed of Dr. Gustav Egloff, petroleum technologist of the Universal Oil Products Company; Dr. Harry L. Fisher, director of research for U. S. Industrial Chemicals, Inc.; Dr. Robert J. Moore, manager of the Development Laboratory of the Bakelite Corporation; Dr. Maximilian Toch, president of Toch Brothers, Inc., and chairman of Standard Varnish Works, and Howard S. Neiman, secretary of the institute.

SCIENTIFIC NOTES AND NEWS

DR. THOMAS M. RIVERS, director of the Hospital of the Rockefeller Institute, has been elected to honorary membership in the Royal Medical Society of Edinburgh.

THE twenty-first Duddell Medal of the Physical Society, London, has been awarded to Dr. F. W. Aston, fellow of Trinity College, Cambridge, in recognition of his invention and development of the mass spectrograph.

THE Alfred Noble Prize of $500, awarded for an "outstanding paper in electrical engineering," was presented on January 27 at a joint meeting of the American Institute of Electrical Engineers and the Institute of Radio Engineers to W. R. Wilson, engineer with the General Electric Laboratories at Pittsfield, Mass.

THE Medalla Oficial, National Order of Merit, Carlos Manuel de Cespedes, has been conferred on Dr. J. C. Geiger, director of public health of the City and County of San Francisco. The citation refers to Dr. Geiger as "a talented physician and scientist, humanitarian and loyal friend of Cuba and other Spanish American countries."

THE 1944 awards of the Albert and Mary Lasker Foundation, $500 in cash with a plaque and scroll, were presented, on January 24, to Dr. John MacLeod, of the department of anatomy of the Cornell University Medical College, and to Dr. Felix J. Underwood, executive officer of the Mississippi State Board of Health, at a dinner in New York City given at the annual meeting of the Planned Parenthood Federation of America.

THE Mineralogical Society of America has elected the following officers: *President,* K. K. Landes, University of Michigan; *Vice-president,* George Tunell, Geophysical Laboratory, Washington, D. C.; *Secretary,* C. S. Hurlbut, Jr., Harvard University; *Treasurer,* Earl Ingerson, Geophysical Laboratory, Washington, D. C.; *Editor,* Walter F. Hunt, University of Michigan; *Councilors,* R. E. Grim, Illinois Geological Survey, Urbana, and Michael Fleischer, U. S. Geological Survey, Washington, D. C.

DR. EDWIN B. FRED, since 1943 professor of bacteriology and dean of the College of Agriculture of the University of Wisconsin, dean of the Graduate School, has been named president of the university. He succeeds Clarence A. Dykstra, who has become the provost of the University of California at Los Angeles.

DR. WILLIAM H. TALIAFERRO, Eliakim Hastings Moore distinguished service professor of parasitology and dean of the Division of the Biological Sciences of the University of Chicago, has been made adviser to the president in the biological sciences. Dr. Roland W. Harrison, professor of bacteriology,

acting dean of the Division of Biological Sciences, will succeed Dr. Taliaferro as dean of the division.

DR. F. J. SICHEL, of the College of Medicine of the University of Vermont, has been promoted to a professorship of physiology and has become chairman of the department of pharmacology and physiology.

DR. GEORGE G. DEAVER, of the New York University College of Medicine, associate and medical director of the Institute for the Crippled and Disabled, and director of the program for training technicians in physical therapy, has been named clinical professor in charge of physical medicine to direct the newly established division, financed under a $250,000 grant made last spring by the Baruch Committee on Physical Medicine, to aid in the physical rehabilitation of wounded war veterans and the civilian disabled. He will supervise the physiotherapy and occupational therapy services of Bellevue Hospital and will coordinate this work with the rehabilitation opportunities afforded by the institute.

DR. S. D. RUBBO, senior lecturer in bacteriology at the University of Melbourne, has been appointed to the chair of bacteriology.

THE Eli Lilly and Company has made a grant of $2,500 to Dr. Donald Slaughter, of the Southwestern Medical Foundation, Dallas, Texas, for a study of aspergillic acid and other anti-biotics in the department of pharmacology to be carried out by Dr. A. Goth, assistant professor of pharmacology.

FRANCIS L. SCHMEHL, formerly assistant chemist in the Section of Malaria of the National Institute of Health, Bethesda, Md., has been appointed associate chemist at the Research Center at Beltsville of the Bureau of Animal Industry, U. S. Department of Agriculture.

DR. K. A. C. ELLIOTT, in charge of the Chemical Research Laboratories of the Institute of the Pennsylvania Hospital, Philadelphia, has been appointed assistant professor in neurochemistry at McGill University and a member of the research staff of the Montreal Neurological Institute.

HUGH S. BARNABY, of Purdue University, has become a member of the pharmaceutical research staff of the Calco Division of the American Cyanamid Company.

DR. H. V. HALVORSON, professor of bacteriology at the University of Idaho, has leave of absence for a year which he is spending at the University of California at Berkeley, working in the laboratory of Professor W. V. Cruess and Dr. R. H. Vaughn.

DR. WEI CHANG CHU, instructor in pharmacology at the Kweiyang Medical College, arrived in San Francisco on January 24. He has leave of absence from the Chunking Government for two years for work in the department of pharmacology of the School of Medicine of Stanford University.

THE *Journal* of the American Medical Association reports that Dr. Maurice L. Tainter, director of research, and Dr. Chester M. Suter, director of chemical research, of the Winthrop Chemical Company, Inc., Rensselaer, N. Y., and New York City, have arrived in Cairo on invitation of the Egyptian Government, to assist in research on tropical diseases. They will spend several months investigating malaria, schistosomiasis, a liver infestation and trachoma.

DR. G. M. BENNETT, professor of chemistry at King's College, London, has been appointed government chemist in succession to the late Sir John Fox, F.R.S. He will take up this work in the late summer of the present year.

DR. GERALD WENDT, science adviser of Time, Inc., will give a series of eight lectures beginning on February 9 for the John L. Elliott Institute of Human Relations. The course, entitled "Science Challenges Society," will be given on Friday evenings from February 9 to March 30.

DR. ALBERT F. BLAKESLEE, of the department of botany and the Genetics Experiment Station of Smith College, from January 18 to 25 gave lectures at the University of Arkansas, Fayetteville, at Oklahoma A. and M. College, Stillwater, and at the University of Oklahoma, Norman, on "Controlling Evolution and Life Processes in Plants." He also spoke before biological seminars at these institutions on "Gene Mutations in Datura" and gave after-dinner talks on "Our Expanding Universe of Knowledge and Adjustments Necessary in Research and Education."

AT the request of the War Committee on Conventions, Washington, D. C., the Institute of Medicine of Chicago has cancelled its Midwest Conference on Rehabilitation, which it had planned to hold at Chicago on February 12.

To cooperate fully with the government in meeting difficulties of transportation, the annual spring meeting of the American Chemical Society will not be held in 1945.

THE Cold Spring Harbor Symposium on Quantitative Biology, on "Variability and Heredity in Microbiology," which was planned for this summer, has been postponed until next year. This decision was reached by the Board of Directors of the Long Island Biological Association, at its January meeting, because of the uncertainties of travel and the difficulty of securing the necessary labor to maintain living quarters and food service.

AS a result of a conference of fifty business leaders held in New York on January 12, a committee of eight industrial executives, with Charles E. Wilson, president of the General Electric Company, as chairman, has been appointed by the Secretary of Commerce to advise the department and the American Standards Association of future plans for standards work and to make recommendations in regard to the relative roles that should be played by government and industry in standards activities. Serving with Mr. Wilson on the committee are: Frederick M. Feiker, dean of engineering, George Washington University; Clarence Francis, chairman of the Board of the General Foods Corporation; Ephraim Freedman, R. H. Macy and Company, Inc.; Frank B. Jewett, president of the National Academy of Sciences; William B. Warner, president of the McCall Corporation; Arthur D. Whiteside, president of Dunn and Bradstreet, Inc., and R. E. Zimmerman, vice-president of the U. S. Steel Corporation. The conference, presided over by Wayne C. Taylor, Under Secretary of Commerce, recommended that industry should provide strong leadership in the development of national standards and that this should be done in full cooperation with the Government.

AN editorial article in the Richmond *Times-Dispatch* calls attention to the program of conservation now being developed by the Virginia State Department of Education under the immediate direction of A. L. Wingo. The project was originally suggested by Dr. Wortley F. Rudd, past president of the Virginia Academy of Science and of the Southern Association of Science and Industry. It has as its ultimate aim a course of study in the public schools to acquaint Virginia children with the material potentialities of their respective communities and of the State as a whole.

AT the University of California at Los Angeles, fellows working in organic chemistry are Dr. Philip H. Dirstine, holder of the Dow post-doctorate fellowship, and Tod W. Campbell, holder of the Abbott fellowship. Seymour Lindenbaum, Sharp and Dohme research assistant, is working on the synthesis of compounds related to Vitamin A. In the biochemical fields allied with the amino acid research of Dr. Max Dunn are research associates Dr. S. Shankman and Dr. H. F. Schott and research assistants, Bruce Merrifield, Merrill Camien, Louis B. Rockland, John Murray, E. A. Murphy and Willi Frankl. Among the subjects they are investigating are yeast proteins, amino acids in animal nutrition and amino acids in micro-biological analysis. Dr. William G. Young, chairman of the department, stated that grants and their donors include the U. S. Quartermaster Corps, $10,000; the Committee on Medical Research, $36,000; the Nutrition Foundation, $3,000; Gelatine Products, $5,000; Sharp and Dohme, $2,700; Dow Chemicals, $2,400; Schering-Glatz Company, $1,800; Merck and Company, $1,500; Anheuser-Busch, $1,500; Vio-Bin Corporation, $1,000; the Abbott Laboratories, $750. An additional grant of $7,500 from Swift and Company will be used when conditions permit.

A DIVISION of Food Technology has been established at the Massachusetts Institute of Technology to study post-war problems of world food production, including the improvement of products, and methods for retaining natural flavors and nutritive elements in processed foods. Under the department of biology and biological engineering it will be directed by Professor Bernard E. Proctor, for many years a member of the staff, who has returned from leave of absence as director of subsistence and packaging research for the Quartermaster Corps of the United States Army. The program includes a new five-year course offering special opportunities for returning service men in the field of food technology. Each student will spend at least six months in food manufacturing plants. The new laboratory bears the name of Samuel Cate Prescott, who until his retirement in 1942 was for many years head of the department of public health.

IT is reported that the Brewing Corporation of America, Cleveland, plans to spend $250,000 for research on the development of new food products based upon the nutritional values of spent brewers' yeast.

AN anonymous gift of $100,000 has been made to the School of Medicine of Stanford University and the sum of $50,000 for use in gathering reference material for the Hoover Library.

THE Nuffield Foundation has established a department of neurology at the University of Liverpool. The services of the department will be available both to voluntary and municipal hospitals throughout the district. The trust, after considering a report on the proposal by its Medical Advisory Council, has made a grant to the university of £3,000 a year for five years, and the balance of the income required is now being collected. A promise of the capital expenditure which will fall upon the university has already been obtained from an anonymous benefactor. The trust will make available financial assistance to the extent of £15,000 to enable the University of Leeds to establish a whole-time chair in psychiatry, with which will be associated a complete psychiatric unit. Facilities will be provided for both undergraduate and post-graduate instruction and for research in the various branches of psychological medicine as well as for treatment.

THE correspondent at Ottawa of *The Times*, London, reports that the Commonwealth and Empire Conference on Radio for Civil Aviation has recommended the establishment of a permanent central office in London for the remainder of the war. The conference has been examining war-time radio developments such as radar and their application to civil flying. At the closing session Sir R. Watson-Watt, head of the British delegation, said that projects that have been studied at Ottawa will be further examined and tested by radio and aviation authorities in the countries of the Commonwealth during the next few months and that the data made available would finally become the subject of international consideration.

THE information *Bulletin* of the Embassy of the U.S.S.R. states that five miles from Tashkent the Uzbec Scientific Research Institute of Forestry is laying out a park. On an area of about a hundred acres a protected zone has been planted with lanes of oaks and sycamores, poplars, walnut trees, chestnuts, limes, fruit trees and roses. There is a nursery containing a hundred and forty different types of trees and bushes. A meteorological station has been established to study prevailing winds. It is hoped to grow about a thousand, five hundred different kinds of trees and bushes. The park will be the largest nursery in the Republic, from which state farms, collective farms and towns will be able to obtain specimens of new types of plants.

DISCUSSION

THE MEANING OF HYDROPONICS

CORRECT terminology is requisite to scientific progress. The incorrect terms which were used in attempts to describe soilless crop production before its scientific basis could be clarified have caused wide misconceptions of its principles and have markedly delayed the establishment of this method to wide use.

Soilless crop production consists of growing crops in water, containing chemicals. Large shallow basins for the water, and wood shavings, sawdust, straw or other waste vegetable litter for seedbeds which support the plants in the water are essential equipment. Water causes the architecture of the roots of plants to become different from those growing in the soil. These differences in architecture are reflected in the functions of the roots. For this reason some crops can be grown more economically without soil than with soil, and by the same tokens others can not.

The revolutionary feature of soilless crop production consists in the substitution of the dynamics of fluids for the dynamics of a porous solid in the universe of growth of land plants. Fluids can not provide anchorage for the roots, hence their architectures become different from those growing in the soil. This change is according to a fundamental biologic law—an organ atrophies or changes in form and function in an environment in which some of its functions can not operate. In the differences of root growth of plants in water from those of the soil is a universe of new phenomena whose interpretation can be formulated into a distinctive category of knowledge.

Because plants grow according to the activities of their roots, and as the dynamics of water changes these from their soil types according to a pattern that can be described and formulated, hydroponics[1] meaning *water working* was chosen as the name for the art and the science of crop production without soil.

Terms as chemical farming, chemiculture, nutrient solution culture and kindred expressions not only were inappropriate but did great harm to this development in its crucial formative period, as they created a wrong perspective concerning the scientific basis of soilless crop production. These terms projected the functions of the nutrients into the foreground and thereby distorted their relative position of importance to other essential factors. This distortion obscured the perspective of the outstanding determinants of the system—the dynamics of water and the physical influences of the seedbed. Likewise, the term soilless agriculture is misapplied, as it is contradictory in meaning and implication—agriculture infers land, that is, solid matter as the home of the roots of plants.

The creation of soilless crop production depended on the solution of three scientific problems. They were:

(1) Establishment of the use of economic materials and the development of simple practical procedures in place of the costly refined materials and the complicated techniques employed in the growing of plants in small glass containers filled with nutrient solutions, in scientific laboratories for experimental studies on the mineral nutrition.

(2) The complete divestment of the water culture method of crop production from the laboratory concepts of water culture which were designed to study the mineral nutrition, in order that hydroponics be provided with its own distinctive basis—the dynamics of fluids substituted for that of porous solids on the root growth of plants. The divestment was necessary in order that the right approach to the practical use of the method could be established.

[1] W. F. Gericke, SCIENCE, 85: 177–8, 1937.