To Dr. Daniel Abramson, assistant in obstetrics, Boston Lying-In Hospital, for chemicals, animals and other expendable materials to be used in a study of the effect of "Relaxin" on smooth muscle, $300.

To Lyman G. Parratt, assistant professor, Cornell University, for equipment and construction of high voltage apparatus for a continuing study of the outer energy levels of solid materials, $325, contingent upon receipt by the recipient of a similar sum from the Rumford Committee or elsewhere.

To Charles W. Turner, professor of dairy husbandry, University of Missouri, for the purchase of experimental animals and feed for a study of the relation of thyroid gland to the fat, carbohydrate and protein metabolism hormones of the anterior pituitary, $500.

To George E. Valley, Jr., national research fellow, Harvard University, for machine work, metal stock, materials and specimens required in his study of the energy and relative intensity of gamma rays from certain atomic nuclei, $450.

To Donald H. Menzel, professor of astrophysics, Harvard University, for the purchase of quartz plates and other materials to construct filters for isolating narrow bands of light to be used in astronomical studies, $450.

To Alfred C. Lane, professor emeritus of geology, Tufts College, to supply certain materials and assistance to Professor Wahl, of Helsinki, Finland, as a part of the program of the Committee on the Measurement of Geological Time of the National Research Council, $250, provided that means can be found to forward materials and funds to the above destination.

To Alvin L. Moxon, experiment station chemist, South Dakota State College, Brookings, South Dakota, for materials and animals to be used in his investigation of the antagonism between arsenic and selenium as it relates to selenium poisoning of livestock, $300.

To Martin D. Whitaker, instructor of physics, New York University, a final grant for the rental of a radium beryllium source to continue his investigation in slow neutron scattering which was supported from this fund in the calendar year just completed, $500, contingent upon the applicant's ability to secure $350 from some other source.

To Hugh M. Huffman, assistant professor of biochemistry, California Institute of Technology, for construction of a semimicro bomb to be used in his continuing studies of the application of thermodynamics to physiological processes, $400, contingent upon his assurance that funds will be available for the remainder of the cost of the problem outlined by him.

To James A. Beattie, professor of physical chemistry, of the Massachusetts Institute of Technology, a final grant for materials and construction of a cryostat to cover the temperature range 0° to −270° C. to be used in his studies in the absolute temperature scale from −270° to +450° C., $500.

## THE CHEMICAL EXPOSITION

AN Industrial Chemical Conference will be held in connection with the National Chemical Exposition from December 11 to 15 at the Stevens Hotel in Chicago. At this conference new discoveries and developments in the service of chemistry and its application and progress in many fields of activity will be discussed.

Announcement is made that the directors of the exposition, sponsored by the Chicago Section of the American Chemical Society, believe that its objectives may be enhanced by furnishing the latest scientific information as well as the practical education that will result from a visit to the exhibition.

Dr. R. C. Newton, chairman of the exhibition committee, states:

> We have arranged for this Industrial Chemical Conference an excellent program of papers in the nature of symposia on "Newer Developments in Chemistry and Chemical Engineering." The program is timed to afford those who wish to hear the talks in which they are interested ample opportunity also to view the show.

Technical sessions for the conference have been arranged for Thursday afternoon and evening, December 12; Friday morning, December 13, and Saturday afternoon, December 14. The regular monthly meeting of the Chicago Section of the American Chemical Society will be held on Friday evening, December 13.

Dr. Newton states that in addition to speakers there will be a number of new films shown on a variety of subjects. It is planned to set aside a room for the frequent showing of films that should be of interest to those attending the exposition.

The committee estimates that approximately 40,000 chemists will attend the exposition and conference, including chemists, chemical engineers, operating engineers, production managers, plant superintendents, buyers and company executives. Exposition floor space is limited to 38,000 square feet, more than 75 per cent. of which has already been assigned.

# SCIENTIFIC NOTES AND NEWS

THE Sedgwick Memorial Medal of the American Public Health Association has been awarded posthumously to Dr. Hans Zinsser.

THE American Geographical Society has awarded the Cullum Geographical Medal to Dr. Robert Cushman Murphy, curator of oceanic birds at the American Museum of Natural History, and the Charles P. Daly Medal to Professor Carl O. Sauer, chairman of the department of geography at the University of California. The presentation will be made at a meet-

ing of the society to be held in New York on December 20.

THE John Fritz Medal for 1941 has been awarded to Ralph Budd, president of the Chicago, Burlington and Quincy Railroad, for "the improvement of railroad tracks and service, especially the introduction of light-weight streamlined trains." The medal was established in 1902 in memory of John Fritz, who had distinguished himself in improving methods for the manufacture of steel. The board of award is composed of sixteen representatives of the four national societies of civil, mining and metallurgical, mechanical and electrical engineers. The medal will be presented to Mr. Budd at a dinner late in December or early in January.

AT a joint meeting in Urbana, Ill., on November 9, of the Midwest, Central and Cincinnati Sections of the American Association of Cereal Chemists a presentation will be made to Past President George Garnatz, of the Kroger Food Foundation, for his year of service in office. The national president, Claude Davis, of the Noblesville Milling Company, will describe Mr. Garnatz's work, after which Dr. C. H. Bailey, of the University of Minnesota, will make the presentation. Dr. J. H. Shollenberger, of the Northern Research Laboratory of the Department of Agriculture, will speak on "Production and Utilization Aspects of the Wheat Situation."

DR. WILLIAM J. KERR, professor of medicine in the School of Medicine of the University of California, formerly president of the American Rheumatism Association, has been elected an honorary member of the Liga Argentina contra el Reumatismo of Buenos Aires.

THE *Journal* of the American Dental Association reports that at the annual meeting in Cleveland on September 10 the entire day was set aside as "Harvey J. Burkhart Day" in honor of Dr. Burkhart, director of the Rochester, N. Y., Dental Dispensary and of the Eastman Clinics in Europe. Dr. Burkhart was guest of honor at a luncheon in the Hotel Statler, attended by more than a thousand colleagues and friends.

DAVID KEYNES HILL, the son of Dr. A. V. Hill, Foulerton research professor of physiology and secretary of the Royal Society, London, has been elected a fellow of Trinity College, Cambridge, in recognition of his research in physiology.

OFFICERS of the Society of American Bacteriologists have been elected as follows: *President,* Dr. M. L. Isaacs, professor of sanitary science at Columbia University; *Vice-president,* Dr. Edw. J. Keegan, of the department of bacteriology of St. Johns University; *Secretary-treasurer,* Dr. Carroll Grant, professor of bacteriology at Brooklyn College; *Councilor,* Dr. Nicholas Kopeloff, professor of bacteriology at Columbia University.

DR. NORMAN H. CEAGLSKE, of the State University of Iowa, has been appointed assistant professor of chemical engineering at Washington University, St. Louis.

EDWIN D. MCKEE, naturalist of the Grand Canyon National Park and a research associate of the Carnegie Institution of Washington, has been appointed director of the Museum of Northern Arizona. He will join the museum staff on January 1.

FREDERICK G. SWITZER, professor of mechanics and hydraulic engineering and head of the department of mechanics in the Sibley School of Mechanical Engineering of Cornell University, has resigned to become a division engineer with the New York City Board of Water Supply. He will be succeeded at Cornell by Dr. James N. Goodier, who joined the faculty in 1938 as professor of mechanics.

A. M. BUSWELL, professor of chemistry at the University of Illinois, has been appointed the representative of the American Chemical Society on the advisory committee of the U. S. Public Health Service for the Revision of Drinking Water Standards.

DR. J. BURNS AMBERSON, JR., professor of medicine at the College of Physicians and Surgeons, Columbia University, has become a member of the committee on medical education and of the committee on medical research of the National Tuberculosis Association.

ASSISTANT PROFESSOR D. W. KERST has leave of absence from the department of physics of the University of Illinois until September, 1941, for the purpose of developing his induction accelerator in the research laboratory of the General Electric Company.

DR. FREDERICK S. HAMMETT and the statistical staff of the Lankenau Hospital Research Institute will be located at Fiddlers Point, Grenada, Sarasota, Florida, for the winter. The mail address is P. O. Box 347, Sarasota, Fla.

JOSEPH F. ROCK has resigned from a position as research associate in the University of Hawaii because of dissatisfaction on his part with facilities for storage and display of his collection of Chinese books and art objects, some of which had been presented conditionally to the university and the remainder deposited on indefinite loan. Because of his feelings in the matter, the collection has been released to him. He has now returned to China to continue his studies of ancient manuscripts on which he has been working for some years.

THE *News Edition* of the American Chemical So-

ciety states that G. C. Crooks, assistant professor at the University of Vermont, secretary of the Western Vermont Section of the society, has been granted leave of absence in order to accept a call to active duty in the Chemical Warfare Service. For the present he will serve as liaison officer between the offices of the Assistant Secretary of War and the Adjutant General of the State of Vermont.

THE second Barnard Hospital lecture will be given on November 19 by Dr. Carl Voegtlin, chief of the National Cancer Institute, in the auditorium of the St. Louis Medical Society. His subject will be "Possibilities of Improved Therapy for Cancer Patients."

DR. ANDREW C. IVY, Nathan Smith Davis professor of physiology and pharmacology and head of the department at the Medical School of Northwestern University, will give the eighth E. Starr Judd lecture at the University of Minnesota on January 15. The subject of the lecture will be "The Mechanisms of Gastric Secretion."

PROFESSOR JOHN T. BUCHHOLZ, head of the department of botany at the University of Illinois, gave a Graduate College lecture at the State University of Iowa on October 14 on "Genetics of Pollen-tube Growth in *Datura*."

THE Salmon Memorial Lectures will be delivered at the New York Academy of Medicine on the evenings of November 8, 15 and 22 by Dr. Nolan D. C. Lewis, director of the New York Psychiatric Institute and Hospital and professor of psychiatry at Columbia University. The titles of the individual lectures are "Historical Perspectives of Psychiatric Thought," "Modern Ramifications in Psychiatric Thought and Research" and "Prospects for Future Achievement in Psychiatric Research."

THE Hume Cronyn Memorial Observatory of the University of Western Ontario, London, was dedicated on the afternoon of October 25. Greetings from sister observatories and universities were conveyed by Dr. C. A. Chant, director emeritus of the David Dunlap Observatory of the University of Toronto, and by Dr. S. A. Mitchell, director of the Leander McCormick Observatory of the University of Virginia. At the convocation exercises held the same evening, Professor Mitchell was awarded the degree of doctor of laws and gave the address entitled, "Astronomers and Their Telescopes."

APPLICATIONS for the Benjamin Peirce instructorships in mathematics at Harvard University for the year 1941–42 should be sent to the chairman of the department of mathematics. Candidates should have received the doctorate or have done equivalent work.

THE endowment of the Arnold Arboretum of Harvard University has been increased by two recent bequests amounting to $35,932. Of this, $12,880 was from the estate of Miss Grace L. Edwards, and $23,054 from the estate of Mrs. James G. Freeman, the latter to be added to the Laura Lucretia Case Fund.

THE General Education Board has added $12,700 to the grant previously made to the Brush Foundation of the School of Medicine of Western Reserve University for the study of child health and development under the direction of Dr. William Walter Greulich, professor of physical anthropology and anatomy and director of the foundation.

THE Rockefeller Foundation has given £1,000 to the Royal Society of Medicine for the preservation of its library. It is proposed to evacuate to a suitable house a number of the older and irreplaceable periodicals. A member of the library staff will accompany them and will be in telephonic communication with the library in London.

THE University of California at Los Angeles has undertaken to train meteorologists for the U. S. Weather Bureau, the United States Navy and the United States Army. Fellowships are being offered by the Government to students of graduate standing. The work in meteorology will be offered under the direction of Dr. J. Bjerknes, formerly of Bergen, Norway, and Dr. J. Holmboe, of the Massachusetts Institute of Technology. Additional courses in thermodynamics, mathematics, mechanics and astrophysics will also be offered in the program.

SIXTY-FIVE educational institutions have been accredited for chemistry instruction by the Committee on the Professional Training of Chemists of the American Chemical Society, of which Professor Robert E. Swain, of Stanford University, is chairman. The list includes only those institutions of which the committee has been able to make a careful study up to the present time. According to the report, the need for more thorough training in chemistry not only in academic work but in control, development and research in the chemical industries has become particularly apparent in the last two decades. During the depression, the striking fact, of utmost importance to the chemical profession, was uncovered that a large proportion of those in the list of unemployed chemists did not qualify, by training or experience, to hold chemical positions. The American Chemical Society is striving to improve the profession of chemistry. It is fundamental to such a program that the training and experience necessary for a man who is to be called a chemist to be recognized and at least in broad terms specified.

THE *E. W. Scripps*, the research vessel of the Scripps Institution of Oceanography at La Jolla, is

now in the Gulf of California on a three-months scientific cruise. The trip is sponsored jointly by the University of California and the Geological Society of America. Its object is to study the sediments and geology of the bottom of the gulf. Four principal areas will be investigated in detail and soundings will be taken at other points. Dr. Francis P. Shepard is a member of the expedition.

THE American Association of Dental Editors, composed of the editorial staffs of non-proprietary dental journals, is considering a plan to develop means for the abstracting of all articles published in their respective journals. They propose that the editors of individual dental journals agree to furnish and pool abstracts of all articles which they publish. These will be offered to some large group, such as the American Dental Association, for publication.

ACCORDING to *Nature* the Geographical Department of the Northern Sea Route Administration (USSR) has sent out the icebreaker *Sedov* on a new expedition to the northeastern part of the Kara Sea. It will be remembered that the *Sedov* returned to Murmansk on January 29, 1940, after a remarkable drift in the Arctic of twenty-seven months duration. The head of the new expedition is V. I. Vorobyev. The purpose of the expedition is to study one of the most important parts of the Northern Sea Route in the Kara Sea—from Izvestia Tsik Islands to Russky Island. The total length of this part is about two hundred nautical miles. The expedition is to carry out hydrographic and hydrological research: it will make systematic soundings of the depths of the sea, study the currents, wind régime, ice conditions and will carry out magnetic observations.

# DISCUSSION

## ON THE THEORY OF THE SEPARATION OF ISOTOPES BY THERMAL OR CENTRIFUGAL METHODS

THE theory of the separation of the components of a fluid by the thermal process has been discussed in detail by Waldmann, Furry, Jones and Onsager and Debye.[1] The importance of the process has been greatly enhanced by the striking success of its use in the separation of the isotopes of the elements. With this success has come a demand for a more complete knowledge of the functioning of the apparatus for a greater variety of types of gas flow than vertical thermal convection; the calculations of the investigators, mentioned above, were limited to this case. With the realization that similar processes are applicable to the centrifugal method,[2] it seemed that the same general method which will be described in detail in this paper for the thermal case could be applied profitably to that very interesting problem. The results of the calculations for both these cases will be compared in this note. However, the conclusions will be restricted to those systems which have been in operation for a period of time sufficiently long that they have nearly reached a state of equilibrium. For simplicity, a two-dimensional system will be considered in which the mass motion in the fluid is in the direction of the z-axis, and in which the primary effect, either thermal diffusion resulting from a temperature gradient between the walls, is in the x-direction, or that diffusion resulting from a centrifugal field gradient, is radial in the r-direction. It will be convenient to consider a fluid composed of two components with masses $m_1$ and $m_2$ and with concentrations $c_1$ and $c_2$ respectively. For the thermal case the equation of equilibrium can be expressed, for example, for the first component in the form

$$-\rho v \frac{\partial c_1}{\partial z} + \rho D \frac{\partial^2 c_1}{\partial z^2} + \frac{\partial}{\partial x}\left[\rho D\left(\frac{\partial c_1}{\partial x} - \alpha \frac{c_1 c_2}{T}\frac{\partial T}{\partial x}\right)\right] = 0 \quad (1)$$

in which the second term

$$\rho D \frac{\partial^2 c_1}{\partial z^2}$$

can be dropped if the total change in the concentration of the first component is small compared to its initial concentration. This equation is subject to the boundary condition that at $x = 0$ and $x = d$,

$$\frac{\partial c_1}{\partial x} - \alpha \frac{c_1 c_2}{T}\frac{\partial T}{\partial x} = 0$$

and that the net flow across any plane perpendicular to the z-axis is zero, *i.e.*,

$$\int_0^d (\rho v)\, dx = 0, \text{ for all values of } z. \quad (2)$$

To complete the mathematical formulation of the problem the equation must be added which expresses the condition that across any plane perpendicular to the vertical axis the transport of component, one, resulting from diffusion and mass motion must be in equilibrium.

$$0 = \int_0^d \rho\left(-D\frac{\partial c_1}{\partial z} + v c_1\right) dx$$

for all values of $z$. To the approximation that all changes in $c_1$ are small compared to its initial value this equation gives for a column of height, $h$,

$$\frac{\Delta c_1}{h} D \rho_0 d = -\int_0^d \int_0^x \rho v\, dx \left(\frac{\partial c_1}{\partial x}\right) dx$$

[1] Waldmann, *Zeits. f. Physik*, 114: 53, 1939; Furry, Jones and Onsager, *Phys. Rev.*, 55: 1083, 1939; Debye, *Ann. d. Physik*, 56: 284, 1939.

[2] Beams and Skarstrom, *Phys. Rev.*, 56: 266, 1939. U. S. Patent Application, ser. no. 263352, 1939.