

THE HODGKINS FUND OF THE SMITHSONIAN INSTITUTION

BY HELEN WALDO BURNSIDE

In September, 1891, Mr. Thomas George Hodgkins, of Setauket, New York, after requesting and receiving information in regard to the aims and objects of the Smithsonian Institution, placed in the hands of the Secretary the sum of \$200,000, as a gift to the Institution, which was formally accepted at a specially called meeting of the Board of Regents, October 21, 1891.

Mr. Hodgkins stipulated that the income of \$100,000 of his gift should be devoted to the increase and diffusion of more exact knowledge in regard to the nature and properties of atmospheric air in connection with the welfare of man; it was not the donor's intention that the Fund should be limited to special investigation in sanitary science, but that the atmosphere should be considered in its very widest relationship to all branches of research. The income of the remaining \$100,000 was to be applied to the general purposes of the Institution.

Additional gifts were afterward received from Mr. Hodgkins, and, in finally closing the affairs of his estate, he made the Smithsonian Institution his residuary legatee, the general Hodgkins Fund being thus increased by a sum the exact amount of which is not yet definitely known.

In consulting with the Secretary and Assistant Secretary on the application of his gift, Mr. Hodgkins referred to the experiments of Franklin in atmospheric electricity, as an investigation germane to his foundation, and mentioned also the prize awarded by the French Academy of Sciences to Paul Bert for his discovery in regard to the influence of oxygen on the phenomena of vitality, expressing the hope that it might be thought advisable by the Institution to offer some very considerable prize which, by its magnitude, would call general attention to the subject in which he was so greatly interested.

With the intent of thus furthering the donor's wishes, the Hodgkins Prize Competition was announced in March, 1893, a prize of

ten thousand dollars being offered for a paper embodying some new and important discovery in regard to the nature and properties of atmospheric air, the Institution reserving the right to limit or to modify the conditions of this prize should it be found necessary.

A prize of two thousand dollars was offered for the most satisfactory essay on the properties of atmospheric air and the proper direction of future research in that connection, and a prize of one thousand dollars for the best popular treatise on atmospheric air.

The proposed establishment of the Hodgkins medal of the Smithsonian Institution was announced in connection with the prize competition, it being contemplated that this medal might be awarded annually, or biennially, for important contributions to the knowledge of the nature and properties of atmospheric air, or for practical applications of existing knowledge to the welfare of mankind.

The conditions governing the future award of grants to specialists engaged in original investigations of atmospheric air and its properties, were also announced, and many applications for such grants, as well as memoirs in competition for the prizes, were received close upon the general distribution of the circulars, which were issued in English, French, and German.

After an extension of time, decided on in the interest of all who might desire to submit papers, the competition was definitely closed December 31, 1894, two hundred and twenty-nine memoirs, which were eligible under the advertised conditions, having been received from competitors in the United States, France, Germany, England, Scotland, Ireland, Italy, Russia, Austria-Hungary, Norway, Denmark, Finland, Bohemia, Bavaria, Servia, Switzerland, Spain, India, Canada, Mexico, and Argentina.

In organizing the competition, a Committee on Award was appointed as follows: Doctor S. P. Langley, Secretary of the Institution, Chairman *ex officio*, Doctor G. Brown Goode, Assistant Secretary of the Institution, Assistant Surgeon-General J. S. Billings, U.S.A., and Professor M. W. Harrington, Chief of the United States Weather Bureau.

The Foreign Advisory Committee, as first constituted, was represented by Monsieur J. Janssen, Director of the Astrophysical Observatory of Meudon, Paris, Professor T. H. Huxley, F.R.S., and Professor von Helmholtz, President of the Physikalisch-Technische Reichsanstalt, Berlin. Subsequent to the death of Doctor von Helmholtz, Doctor W. von Bezold, Director of the Meteorological Institute at Berlin, was added to the advisory branch of the Committee.

After completing the examination of the papers submitted by the contestants, the committee awarded the first prize, \$10,000, to Lord Rayleigh of London, and Professor William Ramsay of University College, London, for the discovery of argon, a new element in the atmosphere.

The second prize, \$2,000, was not awarded, no contestant complying strictly with the terms of the offer.

The third prize, \$1,000, was awarded to Doctor Henry de Varigny, of Paris, for the best popular treatise on atmospheric air.

Honorable mention was made of twenty-one papers, for three of which a silver medal was awarded, and for six a bronze medal.

The gold medal of the Hodgkins Foundation, announced at the time of the competition as a future contingency, has been bestowed twice: First, April 3, 1899, on Professor James Dewar, F.R.S., of the Royal Institution, London, "in recognition of indefatigable researches, pursued for many years, which have been potent not only in increasing and diffusing a more exact knowledge in regard to the nature and properties of air, but have opened the way for the practical utilization of this knowledge in the advance of human welfare." Second, October 28, 1902, to Professor J. J. Thomson, F.R.S., of Trinity College, Cambridge, England, "in recognition of investigations on the conductivity of gases, especially on the gases that compose atmospheric air." (See plate L.)

A Hodgkins medal in silver, with a copy in bronze, has been presented to Pembroke College, University of Oxford, England, from which James Smithson, the Founder of the Institution, was graduated. These medals are placed in the library of Pembroke, forming an appropriate adjunct to the Smithsonian publications which are transmitted regularly to this establishment.

The prize memoirs, "Argon: A New Constituent in the Atmosphere," submitted in collaboration by Lord Rayleigh and Professor William Ramsay, and "Air and Life," by Doctor Henry de Varigny, as well as several other competitive papers, have been published by the Institution. Papers prepared by investigators working under grants from the Hodgkins Fund have also been issued, and others are in course of publication. Among them the following may be mentioned: "Composition of Expired Air, and its Effects upon Animal Life," by Doctors J. S. Billings, S. Weir Mitchell, and D. H. Bergey; "Atmospheric Actinometry," by E. Duclaux; "Atmosphere, Life and Health," by F. A. R. Russell; "Air of Towns," by J. B. Cohen; "Equipment and Work of an Aero-Physical Observatory," by A. McAdie; "Animal Resistance to Disease," and "Organic



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Matter in the Air," by D. H. Bergey; "Ratio of Specific Heats," by O. Lummer and E. Pringsheim; "Experiments with Ionized Air," and "Structure of the Nucleus," by Carl Barus.

A competitive memoir on life in high altitudes, which was submitted in Spanish by Doctors A. L. Herrera and D. Vergara Lope, of the City of Mexico, has been translated into French and published in that language by the authors under the title "La Vie sur les hauts Plateaux." The Institution has aided in the distribution of this work as recording valuable data relative to the influence of life in high altitudes, and especially concerning the treatment of tuberculosis by altitude. The book discusses also the acclimation of plants and animals to the conditions of high altitudes and, in general, subjects relating to the influence of atmosphere on human life and health. This memoir was one of those awarded a silver medal by the committee.

Frequent applications for grants are received, and notwithstanding the fact that limitations on the use of the Hodgkins Fund render it impossible to aid many promising and doubtless useful researches thus brought to the attention of the Institution, it has still been found practicable to further numerous investigations, some of which have proved noteworthy.

While the Fund is not limited in its application to questions of ventilation and sanitation, those subjects were among the first to receive attention. The reports, which have been published by the Institution, of Dr. J. S. Billings and Dr. S. Weir Mitchell, aided by Dr. D. H. Bergey, on their investigation to determine the nature of the peculiar substances of organic origin contained in the air expired by human beings, furnish practical results, the authors concluding that the problem of securing comfort and health in inhabited rooms depends on the consideration of the best methods of preventing or of disposing of dusts of various kinds, of properly regulating temperature and moisture, and of preventing the entrance of poisonous gases, like carbonic oxide, derived from heating and lighting apparatus, rather than upon simply diluting the air to a certain standard of proportion of carbonic acid present.

An early grant from the Fund was made to Doctors Lummer and Pringsheim, of the Physikalisch-Technische Reichsanstalt, Berlin, for research on the determination of the specific heat of gases, with a view of revising the value of the " γ " constant. The results of this research were communicated, by permission, to the British Association for the Advancement of Science, and issued as one of the *Smithsonian Contributions to Knowledge* in a paper entitled

“A Determination of the Ratio of the Specific Heats at Constant Pressure and at Constant Volume, for Air, Oxygen, Carbon-Dioxide and Hydrogen.” Permission was also granted to issue a German edition of this memoir, and the investigation is to be further prosecuted under the direction of the Reichsanstalt.

An interesting research under a Hodgkins grant has been conducted by Mr. A. Lawrence Rotch, director of the Blue Hill Meteorological Observatory, at Hyde Park, Massachusetts, for experiments with automatic kites, to determine, by means of self-recording instruments, meteorological data in atmospheric strata inaccessible except by mechanical methods of exploring the atmosphere. The highest flight recorded during the experiments at Blue Hill up to July, 1900, was 15,807 feet, or but a trifle less than three miles, the kites carrying up with them meteorological instruments which recorded the elevation, the wind pressure, the dew point, and other facts of interest at the great altitude attained.

In addition to this investigation, in the spring and summer of 1899 Mr. Rotch conducted a short series of experiments in wireless telegraphy, in which kites were employed to raise the transmitting and receiving wires.

It may be noted that Mr. W. A. Eddy, who experimented with the aid of a small grant from the Hodgkins Fund, in 1894, at Bayonne, New Jersey, was the first to demonstrate the adaptability of a modern kite of his own device to the purposes of scientific investigation.

A research on the properties of air in connection with the propagation of sound, conducted by Professor A. G. Webster, of Clark University, has been aided by the Hodgkins Fund. An instrument invented by Professor Webster for use in this investigation gives the physical measure of a sound, not only when constant, but also when rapidly varying. It is expected that this research, which includes experiments on the propagation, reflection, and diffraction of sound, will furnish results of practical value in connection with the question of the acoustics of auditoriums.

Professor William Hallock, of Columbia University, New York, has been aided by the Fund in conducting a research having for its object the analysis of a particle of air under the influence of articulate sounds. This investigation, which has been conducted largely by means of instruments of Professor Hallock's invention, is expected to settle definitely the question of phase differences in the components of complex sound.

A Hodgkins research conducted by Doctor Louis Bevier, of

Rutgers College, has for its object the analysis of vowel sounds, detailed studies of the vowel series from *a* to *u* being in progress.

Professor W. C. Sabine, of Harvard University, who had charge of the design of the new Symphony Hall in Boston, and who has for several years given much attention to the problem of architectural acoustics, has also been aided by a grant from the Hodgkins Fund.

Professor Scripture, of Yale University, whose published researches relating to speech, or phonetics, have called attention to his special investigations, is now working under a Hodgkins grant on the construction of a machine designed "to play the vowels like an organ." Following the rule of the Institution, the application for a grant, in this instance as in others, was submitted to the highest accessible authority for an opinion before approval.

Mr. C. Canovetti of Brescia, Italy, a civil engineer who has been moderately aided by the Fund, has conducted a series of interesting experiments on air resistance, his reports having been accompanied by illustrations and numerical tables showing definitely the progress of his work.

The interesting researches on air currents conducted by Doctor Marey, of the Institute of France, have been recently furthered by aid from the Hodgkins Fund. An article on the history of chronophotography by Doctor Marey, which included a detailed description of his own experiments in this field, especially as applied to the motions of animals and to the movements of waves and currents of liquids which are invisible to the naked eye, was published in the Smithsonian Report for 1901. This investigation is expected to aid materially in the solution of various problems connected with the mechanics of propulsion in fluids, and at the same time to render service in solving practical questions in ventilation, etc.

The Hodgkins research of Doctor Victor Schumann, of Leipzig, on the emission and absorption of the gases of atmospheric air in the ultra-violet spectrum, is reported on in detail in the memoir now about to be published in the *Contributions to Knowledge*. The necessary apparatus for carrying on this difficult research has been designed by Doctor Schumann and constructed with his own hands, and the memoir detailing the course of the investigation contains an account of this special apparatus and the method of using it. So general has been the interest among specialists in this advanced investigation that permission was given to Doctor Schumann to publish without delay, in his own country, significant discoveries made in the course of his experiments.

A grant from the Hodgkins Fund to Professor Morris W. Travers, of University College, London, after the customary reference, examination, and discussion, was recently approved. This research deals largely with the liquid properties of hydrogen, and is reported on in detail in a memoir by Professor Travers, shortly to be issued by the Institution under the title, *Researches on the Attainment of Very Low Temperatures*.

Two memoirs, *Ionized Air* and *The Structure of the Nucleus*, by Doctor Carl Barus, who worked under the Hodgkins Fund, have recently been published by the Institution. On account of the immediate interest attaching to these investigations, Doctor Barus also was allowed to publish preliminary reports of his progress in the scientific journals. The investigation on the structure of nuclei is a continuation of the experiments with ionized air, and outstanding questions in the first memoir have been answered in the second. Both volumes appear among the *Contributions to Knowledge*. This research is interesting not only in its own methods and results, but because of its agreement with the data obtained by other investigators from different experiments and theoretically different points of view.

A recent grant on behalf of Mr. E. C. Huffaker is for the construction and practical application of a device intended to produce a uniform and measured flow of air through a tube of any desired diameter. This apparatus is primarily designed for use in connection with investigations in the line of biology, and it has already been applied to exact experiments in the development of the embryo of the egg. It is hoped that by means of this invention facts may be established which will prove of practical value.

Since 1899, *Terrestrial Magnetism and Atmospheric Electricity*, a journal of which Doctor L. A. Bauer is the editor, has been aided annually by a moderate grant from the Hodgkins Fund in the form of a subscription for a specified number of copies of the journal, to be sent out to specialists and educational establishments, as directed by the Institution.

While any general allotment of the income from the Hodgkins Fund for the purposes of investigation is precluded by the terms of the bequest, an application by an investigator who can comply with the conditions which, in accordance with the stipulations of the donor, necessarily govern the expenditures from the Fund, is sure of serious consideration.