
NATIONAL ACADEMY OF SCIENCES

OF THE UNITED STATES OF AMERICA
BIOGRAPHICAL MEMOIRS
VOLUME XX—EIGHTH MEMOIR

BIOGRAPHICAL MEMOIR

OF

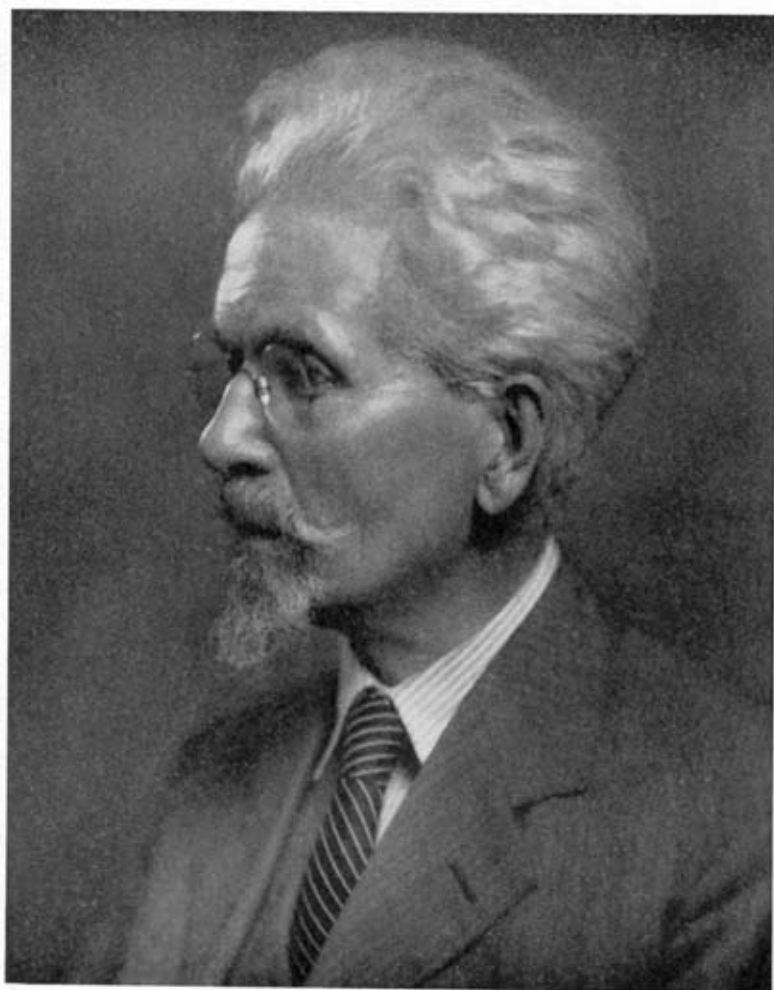
HENRY HERBERT DONALDSON

1857-1938

BY

EDWIN G. CONKLIN

PRESENTED TO THE ACADEMY AT THE AUTUMN MEETING, 1938



Henry H. Donaldson

HENRY HERBERT DONALDSON

1857-1938

BY EDWIN G. CONKLIN

Henry Herbert Donaldson was the son of John Joseph and Louisa Goddard (McGowan) Donaldson. Both his parents were of Irish stock though both were born on this side of the Atlantic; his father was a native of New York where he was a successful banker; his mother was born in Montreal, Canada. She was a handsome woman, noted for her orderliness and great presence of mind, in which qualities her son resembled her. Both his parents lived to an advanced age, his father dying at 79 and his mother at 84; his grandparents also were equally long lived. Their children were Henry Herbert, born at Yonkers, New York, May 12, 1857, and Alfred Lee, born in 1866. The latter like his father was a banker; he was also the author of a "History of the Adirondacks" and was something of a poet and musician. The elder son prepared for college at Phillips Academy, Andover, Massachusetts; he then entered Yale and was graduated in 1879 with the degree of Bachelor of Arts. His father had desired that his son should join him in business but yielding to the young man's preference for science it was agreed that he should enter the medical profession. In further preparation for medicine he spent an additional year at Yale working with Professor Russell H. Chittenden on the detection of arsenic in various organs of the body in cases of arsenical poisoning. The results of this year's work were published jointly with his professor as his first scientific paper. (See appended bibliography.)

During the year 1880-81 he attended the College of Physicians and Surgeons in New York but realizing that his interests were in research rather than medicine he accepted a fellowship in biology in the graduate school of Johns Hopkins University in 1881, which appointment he held for two years, specializing in physiology under Professor H. Newell Martin. As a result of this work he published four papers on physiology and pharmacology, two of them under joint authorship with other students. (See bibliography.)

After his two years as fellow he was appointed student assistant in the department of biology for the year 1883-84. At the close of this academic year he married Julia Desboro Vaux of New York and he and his bride spent the summer of 1884 at Beaufort, North Carolina, in Professor Brooks' laboratory. During the following year he finished his thesis for the doctor's degree under the direction of G. Stanley Hall who was at that time professor of psychology at Johns Hopkins, and was awarded the Ph.D. in 1885. His thesis was entitled "On the temperature sense" and concerned the mapping of heat-sensitive and cold-sensitive areas of the skin. During the following year he was Professor Hall's assistant and they completed and published jointly a paper on "Motor sensations of the skin".

His work on the sensory areas of the skin led him to seek more extensive training in neurology in European centers, and in February 1886 he and his wife and his father went abroad and remained abroad until the autumn of 1887. During their year and a half abroad he worked in Forel's laboratory at Zürich and von Gudden's at Munich and spent some time with Meynert at Vienna and Golgi at Pavia. At the close of this European visit he returned to Baltimore as associate in psychology at the Johns Hopkins University and this position he held from 1887 to 1889.

During his years at Johns Hopkins he was associated or acquainted with a group of unusually able and stimulating fellow students in biology. William T. Sedgwick and Edmund B. Wilson had received the Ph.D. degree the year he entered but K. Mitsukuri, H. W. Conn, Frederick S. Lee and J. Playfair McMurrich were fellow students. In his second year as fellow (1882-83) J. McKeen Cattell and William H. Howell were also fellows in biology, and the following year Adam Bruce and Ethan A. Andrews were fellows in biology, while fellows in other departments included Henry Crew, John Dewey, Woodrow Wilson and other men of brilliant mind who later attained wide distinction. This stimulating fellowship undoubtedly had a great influence on young Donaldson.

In 1888 G. Stanley Hall became president and professor of psychology in the newly founded Clark University at Worcester,

Mass., and in 1889 Doctor Donaldson was called to Clark as assistant professor of neurology. His proven ability in this field led President Hall to assign to him for study the brain of Laura Bridgman, a blind deaf mute who had been taught to speak and had attained marked mental ability. Parts of this long and detailed study were published in 1891 and 1892 and it has been characterized as "probably the most thorough study of a single human brain that has ever been carried out". Of this study Dr. Donaldson has written in a brief autobiographical note: "The chief modifications found in this brain were caused by an arrest of growth due to the destruction of the sense organs. This made it desirable to know the developmental state of the brain at the time of the destructive illness (two years). Such information was not in the literature. With the hope of contributing to fill this gap I arranged a program for the study of the brain (nervous system) from birth to maturity. In carrying out this plan quantitative methods were used and data on the size and weight of the parts and on the number of cells in them were especially considered."

This led him to that long, accurate, quantitative study of growth which was the main theme of his life work. He gathered together all the available material on the growth of the central nervous system and published it in a book entitled, "The growth of the brain: a study of the nervous system in relation to education" (Scribner, 1895).

He remained at Clark University until 1892 when he joined the migration of many of the faculty to the reorganized University of Chicago, where he became professor of neurology and was very active in the development of the scientific departments. From 1892 to 1898 he served as dean of the Ogden Graduate School of Science of the University of Chicago. During this time a tubercular infection of the hip joint interrupted his work and left him permanently lame, but after a prolonged visit to Colorado he returned to his work with courage and determination and from 1898 until his death there was never a year when he did not publish one or more researches.

In 1905 ten professors of anatomy and zoology in leading universities were invited to serve as the Scientific Advisory Board of the Wistar Institute of Anatomy and Biology in Philadelphia. Among these were Charles S. Minot of Harvard, George S. Huntington of Columbia, Franklin P. Mall of Johns Hopkins, George A. Piersol and Edwin G. Conklin of the University of Pennsylvania, Simon H. Gage of Cornell, G. Carl Huber and J. Playfair McMurrich (later at Toronto) of the University of Michigan, Lewellys F. Barker of Chicago (later at Johns Hopkins) and Henry H. Donaldson of Chicago.

On the invitation of the founder of the Institute, General Isaac J. Wistar, and of its Director, Dr. Milton J. Greenman, this Advisory Board met at the Institute in April, 1905 and was asked to propose a plan for the future development of the Institute. It was the unanimous opinion of the Board that the Institute should be devoted primarily to research and in the beginning to research in neurology. This met with the hearty approval of General Wistar, and the Board was asked to recommend some one to organize this work. Dr. Donaldson was the unanimous choice of all the other members and after long and serious consideration he accepted the appointment, and in the following year transferred his activities and his chief assistant, Dr. S. Hatai, from the University of Chicago to the Wistar Institute where he became professor of neurology and director of research.

While at Chicago Donaldson had published one book and seventeen papers, most of them on the human nervous system and that of the frog. However, his attention was called to the peculiar advantages of the albino rat as a laboratory animal in 1893 when Dr. Adolph Meyer had used the rat in a course on the anatomy of the nervous system. One of Dr. Donaldson's associates, Dr. Hatai, had published fifteen papers based on the white rat before removing to Philadelphia. This work on the rat convinced Donaldson that it was the best available mammal for laboratory work on problems of growth. In an autobiographical note he says: "I selected the albino rat as the animal with which to work. It was found that the nervous system of the rat grows in the same manner as that of

man—only some thirty times as fast. Further, the rat of three years may be regarded as equivalent in age to a man of ninety years, and this equivalence holds through all portions of the span of life, from birth to maturity. By the use of the equivalent ages observations on the nervous system of the rat can be transferred to man and tested. The results so obtained show a satisfactory agreement and indicate that the rat may be used for further studies in this field."

For accurate quantitative studies of growth it was necessary to establish a standard stock and to get rid as far as possible of individual differences caused by peculiarities of heredity or environment. Accordingly he and his associates set about the problem of producing a pure bred stock raised under accurately controlled conditions which would give a standardized strain of laboratory animals. How well they succeeded in this is recognized throughout the world by the wide use in the most accurate work of the "Wistar Institute stock" of white rats.

This work on the standardization of a research mammal was summarized in 1915 in a book entitled, "The Rat: Reference tables and data for the albino rat and the Norway rat" (Memoir of the Wistar Institute). A revised and enlarged edition of this book was published in 1924. It may be said that this work renders a service in mammalian research comparable to that of pure chemicals in chemical research or to the "Tables of Physical Constants" in the physical sciences. Largely because of this work the albino rat has become the most widely used laboratory mammal.

The major theme running through the whole of Donaldson's work was organic growth. In his presidential address before the Association of American Anatomists in 1916-17 he said: "Were I asked to name some direction in which we might extend our work I should naturally lay weight upon post-natal growth in the terms of cell multiplication and cell structure, with its many subsidiary problems." Much of this work was on the nervous system, but it was extended to include muscles, viscera, skeleton and teeth, both in normal and in experimental conditions. Several papers were on the number of nerve cells and fibers, others on the size of these, and many papers were

devoted to the effects of domestication, exercise, feeding, castration and age on the size and weight of particular organs. The determinations of the percentage of water in the central nervous system under all of the experimental conditions named constitute a large section of his work.

Altogether he personally published nearly one hundred papers and monographs on these subjects, and his students, assistants and associates published more than three hundred and sixty separate articles on these and related subjects. His method of directing the research work of associates is well described in his published report to the Wistar Advisory Board in 1925 (pp. 46-48): "No investigator is ever asked to do anything which is not for his individual and scientific welfare. For the most part those who come to the Institute are in the early stages of their scientific work and do not bring their problems with them. It is for us, therefore, to suggest one. . . . As an aid in obtaining orderly data which will interlock, the custom of dealing with papers used by the distinguished physiologist Carl Ludwig has been followed. The papers of the younger men have been in every case read critically by some member of the staff familiar with the field, with the new observations brought into relation with those previously published from the Institute. Such criticism assists the younger writer in several ways and also makes it possible to tie together the results of consecutive studies in a manner that gives them cumulative value.—In every case the investigators receive full personal credit for their work. This is as it should be, for it is the virtue of academic laboratories that the emphasis is put on the individual rather than on the institution."

Among the many fellow workers who were associated with him at the University of Chicago and the Wistar Institute the following should receive especial mention: Irving Hardesty, S. Hatai, Alice Hamilton, John B. Watson, S. W. Ranson, W. H. F. Addison, Ezra Allen, A. W. Angulo, G. E. Coghill, Eunice C. Greene, Frederick S. Hammett, Helen Dean King, W. and M. C. Koch. In addition to these some forty other investigators were associated with him in his work.

His interest in and sympathy with all types of good scien-

tific work were broad and generous. He had keen appreciation of good literature, music and the graphic arts. His concern with social problems and human welfare was deep and genuine, and even his closest friends never learned from him of his generous contributions and acts of kindness to those who were in need. His students and colleagues knew him as a man of infinite patience, even temper and nobility of character and they loved and honored him. Among those who published work done in his laboratory were some thirty Americans, twenty Japanese and a smaller number of other nationalities; many of these persons are leaders in their professions and all of them revere his memory.

For his eminence in research he received the honorary degree of Sc. D. from Yale in 1906 and from Clark University in 1937. He was elected president of the Association of American Anatomists for 1916-18, of the American Society of Naturalists in 1927 and of the American Neurological Association in 1937. He was elected to membership in the American Philosophical Society in 1906 and was a Councillor of the Society for four terms of three years each, namely, 1911-13, 1915-17, 1928-31, 1932-36; he was chairman of the Publication Committee from 1932 until his death and was instrumental in establishing the new series of *Memoirs* of the Society, and from 1935 until his death he was a vice-president of the Society. He was a member of the Corporation of the Marine Biological Laboratory from its foundation in 1888 until his death and a Trustee from 1912 to 1929 when he became Trustee Emeritus. In 1911 he established his summer home at Woods Hole, Massachusetts and every summer thereafter, with the exception of two when he was abroad, he carried on his research work there at the Marine Biological Laboratory. He was elected to membership in the National Academy of Sciences in 1914 and was a member of the Council in 1919. He was also an honored member of ten other American and foreign scientific societies. For twenty years he was president of the Lenape Club of the University of Pennsylvania and on the occasion of his eightieth birthday in 1937 a bronze portrait medallion of him, made by Dr. R. Tait McKenzie, was placed in the Club

with appropriate ceremonies and a replica of the medallion now hangs in the hall of the American Philosophical Society.

On the seventy-fifth anniversary of his birth, May 12, 1932, a special anniversary volume of the *Journal of Comparative Neurology* was dedicated to him. It was preceded by an admirable portrait and contained a brief sketch of his distinguished career, followed by twenty scientific contributions from associates and friends and the following affectionate testimonial and address:

"Professor Donaldson's long and productive career is an illustrious example of rigid adherence to a well planned program of research on a fundamental theme without wavering or diversion by opportunistic considerations. He is internationally known as a worthy representative of the best traditions of American science and he has won the respect of the scientific world for his consistent and fruitful program of research.

"He has won the esteem and affection of the Editorial Board by unflinching courtesy, loyal friendship and generous support of all worthy enterprises. For his cordial and invaluable cooperation and wise council during nearly thirty-five years the *Journal of Comparative Neurology* owes him much.

"Professor Donaldson: We your colleagues on this anniversary offer our congratulations upon your past achievements, and we rejoice with you in the realization that your productiveness in research and in the wider field of human relationships continues in full vigor and efficiency. We know, too, that the universities and other organizations which you have so ably served in the past and all the numberless friends who have the good fortune to know you personally wish to join with us in this expression of appreciation."

His personal appearance was so distinguished that it always commanded attention and admiration. Any one who had once seen him could never forget his magnificent head, his steady sympathetic eyes, his gentle smile. With these were associated great-hearted kindness, transparent sincerity, genial humor. Perhaps his most distinctive personal characteristic was the quality which Sir William Osler celebrates in his essay, "*Equinimitas*." With this were naturally associated orderli-

ness, persistence, serenity. His laboratory and library were always in perfect order, his comings and goings were as timely as the clock, he never seemed hurried and yet he worked "Ohne Hast, ohne Rast."

In 1884 he married Julia Desboro Vaux of New York, who died in 1904. Two children were born to them, John C. Donaldson, now professor of anatomy in the Medical School of the University of Pittsburgh and Norman V. Donaldson at present secretary of the Yale University Press. In 1907 he married Emma Brace of New York and their hospitable homes in Philadelphia and Woods Hole were known to a host of loving friends.

After his long illness in the middle nineties of the last century he was never in robust health, but was almost never incapacitated for his regular work. Until a few days before his death he was at work as usual in his laboratory at the Institute. His end came as a result of pneumonia and heart failure at his home in Philadelphia on January 23, 1938, in his eighty-first year. With characteristic foresight he and Mrs. Donaldson had sometime before planned the simple and appropriate funeral service which should be held in the event of either's death. His pallbearers were chosen from among his scientific associates and the officers of the Institute, the University of Pennsylvania and the American Philosophical Society. In accordance with the terms of his will his brain was preserved and added to the notable collection at the Wistar Institute and his body was cremated. His work, influence and memory remain to make the world richer for his having lived in it.

BIBLIOGRAPHY OF HENRY H. DONALDSON

- On the detection and determination of arsenic in organic matter. (By R. H. Chittenden and H. H. Donaldson). *Am. Chem. J.*, vol. 2, no. 4, 1881.
- Influence of digitaline on the work done by the heart of the "Slider" terrapin (*Pseudemys rugosa*, Shaw). (With M. Warfield). *Trans. Medico-Chirurg. Fac. of State of Maryland*, 84th Ann. Session, Baltimore, April, 1882.
- The influence of digitaline on the work of the heart and on the flow through the blood-vessels. (With F. L. Stevens). *J. Physiol.*, vol. 4, pp. 165-197, 1883.
- Action of the muriate of cocaine on the temperature nerves. *Maryland Med. J.*, April 18, 1885.
- On the temperature sense. (Ph.D. Thesis). *Mind*, vol. 10, no. 39, 1885.
- Motor sensations of the skin. (With G. Stanley Hall). *Mind*, no. 40, pp. 557-572, 1886.
- Animal heat. *Woods Reference Handbook of the Medical Sciences*, vol. 3, 1886.
- On the relation of neurology to psychology. *Am. J. Psychol.*, February, 1888.
- Notes on the models of the brain. *Am. J. Psychol.*, vol. 4, no. 1, 1891.
- Anatomical observations on the brain and several sense organs of the blind deaf mute, Laura Dewey Bridgman. *Am. J. Psychol.*, vol. 3, pp. 293-342 and vol. 4, pp. 248-294, 1891.
- The size of several cranial nerves in man as indicated by the areas of their cross-sections. (With T. L. Bolton). *Am. J. Psychol.*, vol. 4, pp. 224-229, 1891.
- The extent of the visual cortex in man, as deduced from the study of Laura Bridgman's brain. *Am. J. Psychol.*, vol. 4, pp. 503-513, 1892.
- Preliminary observations on some changes caused in the nervous tissues by reagents commonly employed to harden them. *J. Morph.*, vol. 9, no. 1, pp. 123-166, 1894.
- The growth of the brain: A study of the nervous system in relation to education. Charles Scribner's Sons, New York, 1895.
- The central nervous system. *Am. Text Book of Physiol.*, vol. 2, no. 4, pp. 171-297, 1898.
- Observations on the weight and length of the central nervous system and of the legs in bullfrogs of different sizes. *J. Comp. Neur.*, vol. 8, no. 4, pp. 314-335, 1898.
- A note on the significance of the small volume of the nerve cell bodies in the cerebral cortex in man. *J. Comp. Neur.*, vol. 9, no. 2, pp. 141-149, 1899.
- Observations on the weight and length of the central nervous system, and of the legs in frogs of different sizes (*Rana virescens brachycephala*,

- Cope). (With D. M. Schoemaker). *J. Comp. Neur.*, vol. 10, no. 1, pp. 109-132, 1900.
- The functional significance of the size and shape of the neurone. *J. Nerv. and Ment. Diseases*, vol. 27, no. 10, 1900.
- Growth of the brain. *Woods Reference Handbook of the Medical Sciences*, vol. 2, 1901.
- Review of "Atlas of the nervous system, including an epitome of the anatomy, pathology and treatment" by Christfried Jacob. With a preface by Ad. v. Strümpell. *Psychol. Review*, vol. 8, no. 6, pp. 622-626, 1900.
- Observations on the post-mortem absorption of water by the spinal cord of the frog (*Rana virescens*). (With D. M. Schoemaker). *J. Comp. Neur.*, vol. 12, pp. 183-198, 1902.
- On a formula for determining the weight of the central nervous system of the frog from the weight and length of the entire body. *Decennial Pub., Univ. of Chicago*, vol. 10, pp. 3-15, 1902.
- A description of charts showing the areas of the cross-sections of the human spinal cord at the level of each spinal nerve. (With D. J. Davis). *J. Comp. Neur.*, vol. 13, pp. 19-40, 1903.
- On a law determining the number of medullated nerve fibers innervating the thigh, shank and foot of the frog (*Rana virescens*). *J. Comp. Neur.*, vol. 13, pp. 223-257, 1903.
- On the areas of the axis cylinder and medullary sheath as seen in cross-sections of the spinal nerves of vertebrates. (With G. W. Hoke). *J. Comp. Neur.*, vol. 15, pp. 1-16, 1905.
- Problems in human anatomy. *Science*, vol. 21, pp. 16-26, 1905.
- Some aspects of the endowment of research. *Science*, vol. 23, no. 582, pp. 282-286, February 23, 1906.
- A comparison of the white rat with man in respect to the growth of the entire body. *Boas Anniversary Volume*, pp. 5-26, 1906.
- Rana pipiens*. *Science, N.S.*, vol. 26, no. 655, p. 78, July 19, 1907.
- Document of the Report of the President of the Brain Commission (Br. C.) by Waldeyer. Translated from the German by Henry H. Donaldson. *J. Comp. Neur.*, vol. 18, no. 1, pp. 87-90, 1908.
- Cooperation in biological research. *Science, N.S.*, vol. 27, no. 688, pp. 375-377, March 6, 1908.
- Review of "Die Grosshirnrinde des Menschen in ihren Massen und in ihrem Fasergehalt," by Dr. Theodor Kaes. *Anat. Rec. (no. 8) in Am. J. Anat.*, vol. 7, no. 4, pp. 242-251, 1908.
- The nervous system of the American leopard frog, *Rana pipiens*, compared with that of the European frog, *Rana esculenta* and *Rana temporaria (fusca)*. *J. Comp. Neur.*, vol. 18, no. 2, pp. 121-149, 1908.
- A comparison of the albino rat with man in respect to the growth of the brain and of the spinal cord. *J. Comp. Neur.*, vol. 18, no. 4, pp. 345-392, 1908.

- Review of "The Problem of Age, Growth and Death," by Charles S. Minot. *Anat. Rec.*, vol. 2, no. 8, pp. 372-377, 1908.
- Translation of the Report of the Executive Committee of the Brain Commission. *Anat. Rec.*, vol. 2, no. 9, pp. 428-431, 1908.
- On the relation of the body length to the body weight and to the weight of the brain and of the spinal cord in the albino rat (*Mus norvegicus* var. *albus*). *J. Comp. Neur.*, vol. 19, no. 2, pp. 155-167, 1909.
- Further observations on the nervous system of the American leopard frog (*Rana pipiens*) compared with that of the European frogs (*Rana esculenta* and *Rana temporaria*). *J. Comp. Neur.*, vol. 20, no. 1, pp. 1-18, 1910.
- On the percentage of water in the brain and in the spinal cord of the albino rat. *J. Comp. Neur.*, vol. 20, no. 2, pp. 119-144, 1910.
- On the influence of exercise on the weight of the central nervous system of the albino rat. *J. Comp. Neur.*, vol. 21, no. 2, pp. 129-137, 1911.
- The effect of underfeeding on the percentage of water, on the ether-alcohol extract, and on medullation in the central nervous system of the albino rat. *J. Comp. Neur.*, vol. 21, no. 2, pp. 139-145, 1911.
- An interpretation of some differences in the percentage of water found in the central nervous system of the albino rat and due to conditions other than age. *J. Comp. Neur.*, vol. 21, no. 2, pp. 161-176, 1911.
- Note on the influence of castration on the weight of the brain and spinal cord in the albino rat and on the percentage of water in them. (With S. Hatai.) *J. Comp. Neur.*, vol. 21, no. 2, pp. 155-160, 1911.
- Studies on the growth of the mammalian nervous system. Philadelphia Neurological Society, President's Address. *J. Nerv. and Ment. Dis.*, vol. 38, no. 5, pp. 257-266, 1911.
- On the regular seasonal changes in the relative weight of the central nervous system of the leopard frog. *J. Morph.*, vol. 22, no. 3, pp. 663-694, 1911.
- A comparison of the Norway rat with the albino rat in respect to body length, brain weight, spinal cord weight and the percentage of water in both the brain and the spinal cord. (With S. Hatai.) *J. Comp. Neur.*, vol. 21, no. 5, pp. 417-458, 1911.
- A comparison of the European Norway and albino rats (*Mus norvegicus* and *Mus norvegicus albinus*) with those of North America in respect to the weight of the central nervous system and to cranial capacity. *J. Comp. Neur.*, vol. 22, no. 1, pp. 71-97, 1912.
- On the weight of the crania of Norway and albino rats from three stations in western Europe and one station in the United States. *Anat. Rec.*, vol. 6, no. 2, pp. 53-63, 1912.
- Review of "Localization Motrice et Kinesthesique," by Edouard Willems. *J. Nerv. and Ment. Dis.*, vol. 39, no. 1, pp. 67-72, 1912.
- Research foundations in their relation to medicine. *Science, N.S.*, vol. 36, no. 916, pp. 65-74, July 19, 1912.

- The history and zoological position of the albino rat. *J. Acad. Nat. Sciences of Phila.*, vol. 15, 2nd series, pp. 365-369, 1912.
- An anatomical analysis of growth. *Trans. of the 15th Internat. Congress on Hygiene and Demography*, Wash., D. C., Sept. 23-28, 1912.
- The mutual relations of medical progress and the physician. *Science*, N.S., vol. 38, no. 969, pp. 101-109, July 25, 1913.
- The growth of the brain. *Woods Reference Handbook of the Medical Sciences*, 3rd ed., pp. 387-395, 1913.
- Charles Sedgwick Minot. December 23, 1852-November 19, 1914. *Science*, N.S., vol. 40, no. 1043, pp. 926-927, December 25, 1914.
- Charles Sedgwick Minot. Including Dr. Charles W. Eliot's address on Dr. Minot. *Proc. of the Boston Soc. of Nat. Hist.*, vol. 35, pp. 79-93, 1915.
- The Rat. Reference tables and data for the albino rat (*Mus norvegicus albinus*) and the Norway rat (*Mus norvegicus*). *Mem. Wistar Inst. of Anat. and Biol.*, no. 6, pp. 1-278, 1915.
- Postnatal growth of the brain under several experimental conditions. Studies on the albino rat. (With S. Hatai and H. D. King.) *J. Nerv. and Ment. Disease*, vol. 42, pp. 797-801, 1915.
- The relation of myelin to the loss of water in the mammalian nervous system with advancing age. *Proc., Nat. Acad. Sci.*, vol. 2, pp. 350-356, 1916.
- A preliminary determination of the part played by myelin in reducing the water content of the mammalian nervous system (albino rat). *J. Comp. Neur.*, vol. 26, pp. 443-451, 1916.
- Herrick's "An Introduction to Neurology." *J. Animal Behavior*, vol. 6, pp. 426-432, 1916.
- A revision of the percentage of water in the brain and in the spinal cord of the albino rat. *J. Comp. Neur.*, vol. 27, pp. 77-115, 1916.
- Experiment on the feralization of the albino rat. *Year Book No. 15*, Carnegie Inst. Washington (for 1916), pp. 200-201, 1916.
- Biological problems and the American Association of Anatomists. *Anat. Rec.*, vol. 11, pp. 299-309, 1917.
- More complete titles. *Science*, N.S., vol. 45, no. 1156, p. 190, February 23, 1917.
- Growth changes in the mammalian nervous system. *Harvey Lectures*, series 12, 1916-1917, pp. 133-150. J. B. Lippincott Co., Philadelphia, 1917.
- Introduction to the "Comparative studies on the growth of the cerebral cortex," by Naoki Sugita. Parts I and II in *J. Comp. Neur.*, vol. 28, no. 3, December, 1917; parts III to VIII, vol. 29, nos. 1 to 3, February, April and June, 1918.
- On the increase in the diameters of nerve-cell bodies and of the fibers arising from them during the later phases of growth (albino rat). (With G. Nagasaka.) *J. Comp. Neur.*, vol. 29, pp. 529-552, 1918.
- A comparison of growth changes in the nervous system of the rat with

- corresponding changes in the nervous system of man. *Proc. Nat. Acad. Sci.*, vol. 4, pp. 280-283, 1918.
- Medicine and growth. *Science*, N.S., vol. 49, no. 1266, pp. 315-322, April 4, 1919.
- Quantitative studies on the growth of the skeleton of the albino rat. (With Sara B. Conrow.) *Am. J. Anat.*, vol. 26, pp. 237-314, 1919.
- Report on the studies of Dr. R. S. Ellis touching the structural changes in the human cerebellum from birth to old age. *Trans.*, 46th Annual Meeting Am. Neur. Assoc., New York, June 1-3, 1920.
- On the changes in the relative weights of the viscera and other organs from birth to maturity—albino rat. *Am. J. Physiol.*, vol. 67, pp. 1-21, 1923.
- On the cranial capacity of the guinea pig—wild and domesticated. *Archives Suisses de Neur. et de Psych.*, vol. 13, pp. 206-222, 1923.
- Naming and exact naming. *Science*, vol. 59, p. 554, June 20, 1924.
- The Rat: Data and reference tables. Second edition, revised and enlarged. *American Anatomical Memoir* no. 6, 8 vo., xiv + 469 pp., 212 tables, 72 charts, 13 figures, with bibliography comprising 2329 titles, 1924.
- The significance of brain weight. *Archives of Neur. and Psych.*, vol. 13, pp. 385-386, 1925.
- On the control of the rat population. *Science*, vol. 61, pp. 305-306, 1925.
- Research at the Wistar Institute, 1905-1925. *Bull.*, no. 6, pp. 43-51. Celebration of the 20th Anniversary of the organization of the Advisory Board, 1925.
- Review of "Anatomy of the Wood Rat," by A. Brazier Howell. *Monographs of the American Society of Mammalogists*. *Anat. Rec.*, vol. 34, no. 3, pp. 219-220, December 25, 1926.
- On the growth in the diameters of the molar teeth of the albino rat, after eruption. (With Harley E. French.) *Anat. Rec.*, vol. 34, no. 5, pp. 277-299, February 25, 1927.
- A study of the brains of three scholars: Granville Stanley Hall, Sir William Osler, and Edward Sylvester Morse. (With M. M. Canavan.) *J. Comp. Neur.*, vol. 46, no. 1, pp. 1-95, August 15, 1928.
- Life processes and size of the body and organs of the gray Norway rat during ten generations in captivity. I. Life processes. II. Size of the body and organs. (By Helen Dean King and H. H. Donaldson.) *Am. Anat. Memoir*, no. 14, February, 1929.
- On the growth of the molar teeth after eruption in the albino rat and in the cat. *J. Dental Research*, vol. 9, no. 3, pp. 285-287, 1929.
- On the weight of the parts of the brain and on the percentage of water in them according to brain weight and to age, in albino and in wild Norway rats. (With Shinkishi Hatai.) *J. Comp. Neur.*, vol. 53, no. 2, pp. 263-307, 1931.
- Note on the contour of the foramen magnum in different strains of the Norway rat. *Anat. Rec.*, vol. 52, no. 4, pp. 313-320, 1932.

- The early days of the American Physiological Society. *Science*, vol. 75, no. 1954, pp. 599-601, 1932.
- On the effects of exercise carried through seven generations on the weight of the musculature and on the composition and weight of several organs of the albino rat. (With Ruth Elva Meeser.) *Am. J. Anat.*, vol. 50, no. 3, pp. 359-396, 1932.
- The brain problem—in relation to weight and form. *Am. J. Psychiatry*, vol. 12, no. 2, pp. 197-214, 1932.
- On the effect of exercise beginning at different ages on the weight of the musculature and of several organs of the albino rat. (With Ruth E. Meeser.) *Am. J. Anat.*, vol. 53, no. 3, pp. 403-411, 1933.
- On the increase in the diameters of the molar teeth of the rat after eruption. *J. Dental Research*, vol. 14, no. 5, pp. 323-346, 1934.
- Effect of prolonged rest following exercise on the weights of the organs of the albino rat. (With Ruth E. Meeser.) *Am. J. Anat.*, vol. 56, no. 1, pp. 45-55, 1935.
- Summary of data for the effects of exercise on the organ weights of the albino rat: comparison with similar data from the dog. *Am. J. Anat.*, vol. 56, no. 1, 1935.
- On the percentage of water in the organs of albino rats after prolonged exercise. *Am. J. Anat.*, vol. 59, pp. 55-62, 1936.
- On the growth of the eye in three strains of the Norway rat. (With Helen Dean King.) *Am. J. Anat.*, vol. 60, pp. 203-229, 1937.
- The Nervous Skeleton. Presidential address before the American Neurological Association, Atlantic City, June 3, 1937. *Trans., Amer. Neurological Assn.* 1938.