
NATIONAL ACADEMY OF SCIENCES

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

BIOGRAPHICAL MEMOIR

OF

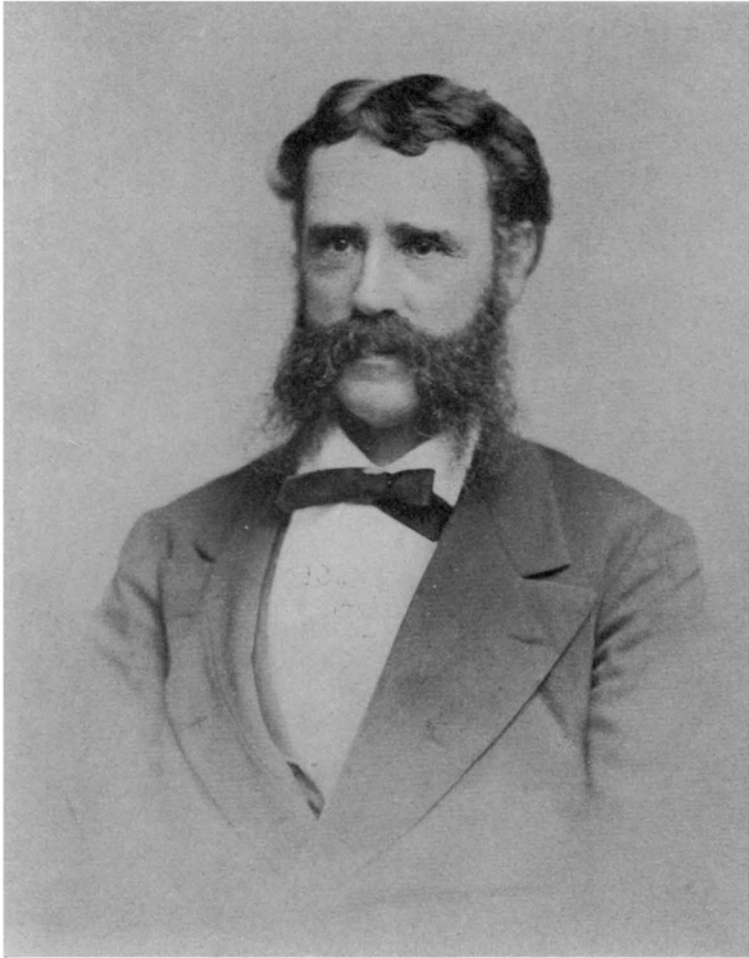
HENRY MITCHELL

1830-1902

BY

H. A. MARMER

PRESENTED TO THE ACADEMY AT THE ANNUAL MEETING, 1938



Henry Mitchell

Feb. 21, 1950

The date of the death of Henry Mitchell is given as Dec. 1, 1902 in the following sources.

Report of the National Academy of Sciences, 1903, p. 12 and in subsequent lists of deceased members.

The National Academy of Sciences 1863-1913/
Dictionary of American Biography.

- - -

Who Was Who lists only the year of death.

- - - - -

The Report of the National Academy of Sciences for the Year 1885 (p. 7) states that he was elected at the Annual Meeting in 1885. His name does not appear in lists of members in the 1883 and 1884 Annual Reports.

The Proceedings, Vol. I, First Series, ^{p.}256, states that he was elected in April 1885.

The date 1885 is carried as the date of election in subsequent lists of members and of deceased members.

D. Flynn

HENRY MITCHELL

1830-1902

BY H. A. MARMER

Henry Mitchell was born on Nantucket Island, Mass., on September 16, 1830, the fourth son in a family of four sons and six daughters of William and Lydia (Coleman) Mitchell. The family was of Quaker stock long settled in America. His mother had been a school teacher prior to her marriage. His father, too, had been a teacher, but later became a bank official and one of the Overseers of Harvard College. Interested especially in astronomy, the father enjoyed a wide acquaintance among American men of science.

At this time Nantucket ranked after Boston and Salem as the third commercial city of the State, its prosperity being due primarily to the whaling industry. Nantucket whalers were ranging the seas from the Arctic to the Antarctic, and this fostered in the island community the study of navigation, including mathematics and astronomy. Henry Mitchell's mother used to relate that in her infancy the little children were taught to box the compass in the "Monthly Meeting School" in place of the catechism.

Young Mitchell obtained his education in private schools and at home where his immediate family furnished good examples and excellent instructors. The well-known astronomer Maria Mitchell was his sister, twelve years his senior. During his youth she was librarian of the Nantucket Athenaeum and was busily engaged in her astronomical labors, sharing her father's enthusiasm for astronomy. Under such conditions Henry Mitchell received a sound training.

In 1849, being then nineteen years of age, he entered the United States Coast Survey. His first assignment was in connection with triangulation, but later he was transferred to the hydrographic branch. Here his abilities soon became manifest. In 1854 he was entrusted with carrying out a tidal survey of Nantucket and Vineyard Sounds. This involved simultaneous observations at different places along the outer and inner

coasts to determine the progress of the tide from the open sea. Difficulties were experienced in the construction of tide gages to withstand the force of the currents and of the breakers at the outside stations. Mitchell was successful in devising a special form of tide gage which could be used on the open sea coast and in situations exposed to strong currents. This he described and illustrated in the appendix to the "Report of the Superintendent of the U. S. Coast Survey" for 1854.

For the following two years he was engaged in studying the complicated system of tides and currents in Nantucket and Vineyard Sounds and in elucidating their movements. In appendices to the Coast Survey Reports for 1856 and 1857, he sketches briefly the salient features of the tides and currents in these waterways. In the latter report, too, he describes a spar form of tide gage for observing tides in deep water and in situations exposed to heavy seas, that he used during the year.

In 1856 he began an investigation of the tides and currents in New York Harbor and vicinity. In this investigation Mitchell had two aims in view: first, the securing of data which would permit the prediction of the tides and currents in the localities in question for the use of the mariner; second, the study of tides and currents as agents of geologic change in molding and changing shore lines and harbors.

In New York Harbor, the tidal phenomena are complicated by the fact that the tide enters the harbor by two channels, one past Sandy Hook, and the other through Long Island Sound. Due to this, very strong currents are brought about in the East River, especially in the vicinity of Hell Gate, with very rapid changes in the time of tide through that waterway.

For studying the subsurface currents, Mitchell devised a simple and ingenious apparatus. To quote his own words "This consists of two large copper globes, as floats, connected by a slender cord, one weighted so as to float when immersed to the depth of four feet, and the other so as to sink to different depths in the currents which it may be desired to investigate. The motion of the apparatus will depend, of course, upon the difference of movement at four feet, the nearly superficial current,

and below, so that, obtaining by the ordinary log the movement at the surface, that below becomes known by observing the motion of the apparatus itself."

The investigation and elucidation of the tidal phenomena in New York Harbor was Mitchell's principal work up to and including the year 1859. Interim reports on the results of these investigations were published in the annual reports of the Coast Survey each year and in the 1859 Report he published an appendix on "The Physical Survey of New York Harbor and the Coast of Long Island, with Descriptions of Apparatus for Observing Currents." In this appendix he summarized briefly the relations existing between the currents and shoals in this region, and described several different forms of apparatus for measuring currents and also a new shape devised for a pile to be used as a support for a tide gage.

Beginning with 1860, Mitchell's attention was turned to the problems involved in the maintenance of the channels of Boston Harbor. In the Coast Survey Report for 1860 he published a discussion of the tides and currents in Boston Harbor. In the same Report he also described two instruments he devised for collecting bottom specimens in alluvial harbors.

Hydrographic surveys and studies of tides and currents along the New England coast and in New York Harbor engaged his attention up to 1866. In 1862 he also made a survey of Oregon and Hatteras Inlets, North Carolina, at the request of the military authorities in connection with the work of the North Atlantic blockading squadron. And in 1864, at the request of the Navy Department, he studied the action of floating ice in Delaware Bay.

In 1866 he enlarged his experience of hydrography to include the southeastern coast of the United States. In connection with a proposed cable uniting the United States and Cuba, he made soundings across the Straits of Florida, embodying the results of his observations in an appendix to the Coast Survey Report for the above-mentioned year. In this Report he also dealt with the difficulties in the way of laying the proposed cable. This work was continued during the following two years, the project

being enlarged to secure data beyond the immediate needs for cable laying so as to derive a better knowledge of the Gulf Stream.

At this time it was thought that a polar countercurrent existed below the northerly setting Gulf Stream, the low temperature of the deeper waters appearing to confirm this theory. Mitchell himself had accepted this polar current theory in a paper presented before the National Academy of Sciences in 1866. But in the Coast Survey Report for 1867 he challenges this theory, stressing the fact that between Cuba and Florida "*the Gulf Stream has a nearly uniform velocity, and constant course for a depth of six hundred fathoms, although its temperature varies in this depth 10° Fahrenheit.*"

The growth of commerce, coupled with the increased draft and size of ships, was at this time bringing the problems connected with harbor improvement to the fore. Desiring to learn the latest developments in European practice, it was decided to send an American engineer to Europe. Although still a comparatively young man at this time, Mitchell was already recognized as an authority in hydrographic matters, and it was therefore natural that he should be chosen. Leaving in May of 1868, he visited Germany, Holland, England, France and Italy, studying canals and harbors and conferring with leading engineers. He also visited Egypt for the purpose of inspecting the Suez Canal which was nearing completion.

In February of 1869 he returned to the United States, and in the *North American Review* for October of that year he published a paper on "The Coast of Egypt and the Suez Canal." In this paper of some thirty odd pages there is not only an engineer's description of a great engineering undertaking, but also the reflections of a scientist on the hydrographic features of a region that posed a variety of problems relative to its development. The concluding paragraph of this paper furnishes a good example both of Mitchell's vigorous style and also of his interest in public matters outside the narrow specialized field of his own chosen profession.

"I have looked in vain through the entire history of this French enterprise in Egypt, to discover the least trace of

earnest effort or sincere co-operation on the part of the Egyptian or Turkish government. I believe that the Viceroys of Egypt, from Mahomet Ali down to the present weak prince, have been coaxed into acquiescence by the master minds that conceived and executed this brilliant work, and I am convinced that this costly avenue, and the commerce employing it, will never be secure from interruption till the territory is neutralized or otherwise wrested from Mohammedan misrule."

Another study resulting from his European investigations, and one of wider scope than the preceding, appeared as an appendix to the Coast Survey Report for 1869 under the title "On the Reclamation of Tide-Lands and Its Relation to Navigation." In this paper he formulates the relations existing between tidal and nontidal currents in regard to channel scour, and the effects of various types of reclamation works.

From his return in 1869 up to 1874 Mitchell was engaged principally with surveys and studies connected with the problems of New York Harbor and harbors along the New England coast. In the summer of 1870 he was also called to the Pacific coast to study the probable effects of extending piers in certain channels of San Francisco Bay. Interim reports on the progress of these studies appeared in the annual reports of the Coast Survey. In the Report for 1871 he also published a paper on "Hints and Suggestions Upon the Location of Harbor-Lines."

Early in 1874 he was appointed a member of the Commission on the construction of an Oceanic Ship Canal and made a personal inspection of suggested routes for the proposed canals through Nicaragua and the Isthmus of Darien. In that same year President Grant appointed him a member of the Board of Engineers to survey the mouth of the Mississippi River. The following year, at the request of James B. Eads, he served as a member of an Advisory Board in connection with the construction of the Mississippi Jetties. From 1875 to 1877 he also served on the Advisory Board to the Harbor Commissions of Virginia and Rhode Island, and in 1879 he was appointed a member of the Mississippi River Commission by President Hayes.

In connection with his work on tides, Mitchell studied the

question of the alleged emergence of the northeastern shores of the American Continent, this thesis being supported by eminent geologists. In a paper entitled "Notes Concerning Alleged Changes in the Relative Elevations of Land and Sea" in the Coast Survey Report for 1877, he made a critical study of the records upon which this thesis was based, and showed conclusively that it was untenable.

Delaware River, forming one of the important waterways of the country, presented numerous problems in connection with harbor improvement. In 1877 a hydrographic survey of this river was made under Mitchell's direction, and in the Report for 1879 he published an appendix under the title "On a Physical Survey of the Delaware River in Front of Philadelphia." Here he gave not only the results of the survey in detail, but also a general dissertation on channels in tidal rivers and the principles involved in the maintenance of such channels.

As a member of the Mississippi River Commission, he studied various problems connected with the Mississippi River. In the Coast Survey Report for 1882, he published a study on the effects of river bends in the lower Mississippi, in which he concluded that bends, on the whole, offer no advantages.

Surveys and studies of the harbors of New York and Philadelphia continued for the next few years, problems in connection with shoals becoming especially important. A careful study of Monomoy and its shoals by Mitchell appeared in the Coast Survey Report for 1886. And in that Report he also published an appendix "On the Circulation of the Sea Through New York Harbor" in which he called attention to the fact that "although the tidal currents of New York, especially in the East River, appear to move to and fro, with ebb and flood, in monotonous repetition, like the swing of a pendulum, there is a *net gain*, under ordinary conditions of river discharge, to the westward, *i.e.*, a permanent transfer of water from the Sound through the harbor and out into the ocean over Sandy Hook Bar." This was a very important discovery, both in elucidating the complex tidal movements in the harbor and in its practical applications in connection with the improvement of the harbor.

In May of 1888 he presented his resignation from the Coast Survey to take effect at the close of work on June 30, having served continuously for 39 years. During this time his attainments had received recognition in the world outside his chosen profession. Various scientific societies honored him by election to membership. In 1867 Harvard College conferred upon him the degree of Master of Arts; in 1869 he was offered the Professorship of Physical Hydrography at the Massachusetts Institute of Technology, and in 1873 the same chair was offered him in the Agassiz School of Science. In 1875 he was elected to the National Academy of Sciences.

Mitchell was married three times. His first wife was Mary Dawes, of Boston, to whom he was married in his early twenties and who left him a widower after twelve years. In 1873, he was married to Margaret Hayward who died in 1875, about five months after the birth of a daughter, his only child. Two years later, he married his deceased wife's elder sister, Mary Hayward. On resigning from the Coast Survey, he led a retired, studious life, spending his summers in Nantucket and his winters near Boston. In 1890, he served as a member of the Commission of the Annual Assay of the Mint; in 1893, he was appointed a member of the Advisory Council of the World's Columbian Water Commerce Congress; and in 1896, he published in the *Proceedings* of the American Academy of Arts and Sciences a biographical sketch of Ferdinand de Lesseps.

A year after his resignation he was offered the Superintendency of the Coast Survey by President Harrison. But Mitchell's health did not permit him to assume the burdens of the office, and he declined the offer. In March 1902 his wife died, following which he made his home with his daughter in New York City, where he died, December 2, 1902.

By a person who knew him in his later life he was described as "a charming and interesting man who shared the characteristics of his sister Maria in an ability to interest his friends wherever he went, conversing with great ease, and much ability to see the humorous side of life. He continued to dress in the style of his time, changing but little with fashion."

BIBLIOGRAPHY

NOTE: The greater number of Mitchell's publications appeared in the annual reports of the Superintendent of the United States Coast Survey. In 1878 the name of the bureau was changed to United States Coast and Geodetic Survey. In this bibliography the reports are specified by the year for which issued and not the date of publication, which was frequently a year later.

- Report [on tidal observations on the south shore of Massachusetts and in Nantucket and Vineyard sounds]. Rpt. 1854, app. 20, pp. 35-37.
- Description of tide-gauge used at stations on the open seacoast and in situations exposed to strong currents. Rpt. 1854, app. 53, pp. 190-191.
- Report on tidal observations in Nantucket sound. Rpt. 1855, app. 33, pp. 222-223.
- Report on the progress of the discussion of the interference tides of Nantucket and Martha's Vineyard sounds. Rpt. 1856, app. 37, pp. 261-263.
- Report on the investigation of the tides and tidal currents of New York harbor and its dependencies and at Sandy Hook. Rpt. 1856, app. 39, pp. 264-266.
- Report of observations of tides and currents in Nantucket and Martha's Vineyard sounds and in the East River at Hell Gate with remarks on the revision of levellings on Hudson River. Rpt. 1857, app. 35, pp. 350-354.
- Letter from the Superintendent, communicating the description of a tide gauge . . . for taking observations in deep water. Rpt. 1857, app. 50, pp. 493-494.
- Report on the investigation of currents in the East River at Hell Gate and Throg's Neck, the sub-currents of New York bay and harbor and levellings on the banks of the Hudson River. Rpt. 1858, app. 28, pp. 204-207.
- Report on the physical survey of New York harbor and the coast of Long Island, with descriptions of apparatus for observing currents. Rpt. 1859, app. 26, pp. 311-317.
- Tides and currents in Boston harbor and observations on tides and currents in Cape Cod Bay and Buzzards Bay. Rpt. 1860, pp. 41-43.
- Description of implements devised for collecting specimens of bottom in alluvial harbors. Rpt. 1860, app. 39, p. 398.
- Report on hydrographic surveys at Oregon inlet and in Neuse River, Military Department of North Carolina. Rpt. 1862, app. 30, pp. 257-259.
- Aids to navigation in Eastport harbor and Penobscot Bay, recommended. Rpt. 1864, app. 23, pp. 223-225.
- Report upon soundings across the Straits of Florida. Rpt. 1866, app. 5, pp. 35-44.
- Preliminary report on the interference tides of Hell Gate, with directions for reducing the soundings. Rpt. 1866, app. 6, pp. 44-46.

- Report to the Superintendent of the Coast Survey on the tides and currents of Hell Gate, N. Y. Rpt. 1867, app. 13, pp. 158-160.
- Report upon surveys in the Merrimack River. Rpt. 1867, app. 14, pp. 170-175.
- Report on soundings made to develop the character of the Strait of Florida between Key West and Havana. Rpt. 1867, app. 15, pp. 170-179.
- Note on Gulf Stream observations. Rpt. 1868, app. 11, pp. 160-167.
- Tides and Tidal Phenomena: for the use more particularly of U. S. naval officers. Navy Scientific Papers, No. 2, 1868.
- On the reclamation of tide-lands and its relation to navigation. Rpt. 1869, app. 5, pp. 75-104.
- Report concerning Vineyard Haven: its character as a port of refuge and its present condition. Rpt. 1869, app. 15, pp. 239-254.
- Report on physical surveys made at Martha's Vineyard and Nantucket during the summer of 1871. Rpt. 1869, app. 15, pp. 254-259.
- The Coast of Egypt and the Suez Canal. North American Review, Oct. 1869, pp. 475-509.
- Extract from a report . . . relative to a method of determining elevations along the course of a tidal river without the aid of a levelling instrument. Rpt. 1870, app. 11, pp. 98-99.
- On the probable effect of extended piers in modifying the channel facilities of San Francisco Bay near Yerba Buena Island. Rpt. 1870, app. 18, pp. 180-181.
- Report (on the harbor of New York: its condition May 1873). Rpt. 1871, app. 8, pp. 110-133.
- Report . . . concerning Nausett beach and the peninsula of Monomoy. Rpt. 1871, app. 9, pp. 134-143.
- Hints and suggestions upon the location of harbor-lines. Rpt. 1871, app. 10, pp. 144-153.
- The middle-ground shoal, New York Harbor. Rpt. 1872, app. 16, pp. 257-261.
- Report on the physical survey of Portland Harbor. Rpt. 1873, app. 8, pp. 94-102.
- Additional report concerning the changes in the neighborhood of Chatham and Monomoy. Rpt. 1873, app. 9, pp. 103-107.
- Note concerning changes in the submerged contours off Sandy Hook. Rpt. 1873, app. 10, pp. 108-110.
- Report on an inspection of the terminal points of the proposed canals through Nicaragua and the Isthmus of Darien. Rpt. 1874, app. 12, pp. 135-147.
- Report concerning recent observations at South pass bar, Mississippi River. Rpt. 1875, app. 11, pp. 189-193.
- Changes in the harbor of Plymouth, Mass. Rpt. 1876, app. 9, pp. 143-146.
- Report upon the physical survey of New York Harbor, 1876. Rpt. 1876, app. 10, pp. 147-185.

- Report concerning the location of a quay or pier line in the vicinity of the United States Navy-Yard at New York. Rpt. 1876, app. 11, pp. 186-189.
- Characteristics of South pass, Mississippi River. Rpt. 1876, app. 12, pp. 190-191.
- Notes concerning alleged changes in the relative elevations of land and sea. Rpt. 1877, app. 8, pp. 98-103.
- On a physical survey of the Delaware River in front of Philadelphia. Rpt. 1878, app. 9, pp. 121-173.
- Physical hydrography of the Gulf of Maine. Rpt. 1879, app. 10, pp. 175-190.
- Addendum to a report on a physical survey of the Delaware River. Rpt. 1879, app. 13, pp. 199-200.
- Report on a new rule for currents in Delaware Bay and River. Rpt. 1881, app. 18, pp. 464-469.
- Study of the effect of river bends in the lower Mississippi. Rpt. 1882, app. 10, pp. 433-436.
- The estuary of the Delaware. Rpt. 1883, app. 8, pp. 230-245.
- A plea for a light on St. Georges Bank. Rpt. 1885, app. 11, pp. 483-485.
- A report on Monomoy and its shoals. Rpt. 1886, app. 8, pp. 255-260.
- A report on the delta of the Delaware. Rpt. 1886, app. 10, pp. 267-279.
- On the circulation of the sea through New York Harbor. Rpt. 1886, app. 13, pp. 409-432.
- On the movements of the sands at the eastern entrance to Vineyard Sound. Rpt. 1887, app. 6, pp. 159-163.
- Addendum to a report on the estuary of the Delaware. Rpt. 1887, app. 13, pp. 269-273.
- Report on the results of the physical surveys of New York Harbor. Rpt. 1887, app. 15, pp. 301-311.
- Circulation of the Sea through New York Harbor. *Science*, Vol. 9 (1887) pp. 213-214.
- Viscount Ferdinand de Lesseps [Biographical notice]. *Proc. Amer. Acad. Arts and Sci. New Series* Vol. 23 (1896) pp. 370-384.