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# BIOGRAPHICAL MEMOIR SIMON NEWCOMB

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BY

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Simon Newcomb

#### SIMON NEWCOMB.

#### By W. W. CAMPBELL.

Simon Newcomb's <sup>1</sup> ancestry was chiefly English, and in minor degrees Scotch, French, German, and Irish. His first paternal ancestors to cross the ocean were the family de Vigne. A son of theirs was the first boy of European stock born on Manhattan Island. Simon Newcomb's mother was a descendant of Elder William Brewster and his son Jonathan, who came with the Mayflower company, and of Elder Prince, of Hull, and others who came later. Newcomb's ancestors in every line had crossed the Atlantic long before the American Revolution, and the American descent was almost entirely through New England families. The first identified Newcomb was a sea captain, who married in Boston in 1663. The first Simon Newcomb was born in Massachusetts or Maine about 1666. His descendants formed the habit of naming their eldest sons after him, and except for the fact that his father was a younger son, the astronomer would have been the sixth Simon Newcomb in unbroken lineal descent.  $\operatorname{His}$ paternal grandfather, Simon Newcomb, who removed to Nova Scotia in 1761, was a stonecutter, but he was credited "with unusual learning and with having at some time taught school;" and he possessed a small collection of books on serious subjects—an algebra, a Euclid, a navigator, The Spectator, etc.—which were destined to influence profoundly the life of our colleague.

The astronomer's father, John Burton Newcomb, was by profession a country schoolteacher. He was a strong character in some ways, and he had the distinction of being an early exponent of the principles of eugenics. After careful study he concluded that a man should marry at the age of 25, and that the wife should have certain temperamental characteristics and be mentally gifted. When John Newcomb "found the age of 25 approaching he began to look about. There was no one in (his village of) Wallace who satisfied the requirements. He therefore set out afoot to discover his ideal." His searches were in vain until they had extended nearly a hundred miles from home and into the neighboring Province of New Brunswick. Hearing the strains of music from a church he went in, and there found his future wife, Emily Prince, in the person of the organist and leader of the singing. Emily's father had migrated from Maine to New Brunswick early in life, where he became a widely known and highly respected citizen of the Province. John Newcomb always "expressed the highest admiration for Emily Newcomb's mental gifts, to which he attributed whatever talents his children might have possessed."

Simon Newcomb, the astronomer, was born on March 12, 1835, at Wallace, on the north coast of Nova Scotia. As the teaching profession in those days was an almost nomadic one, the movings of the family were frequent, and Simon's childhood and boyhood were lived in various parts of Nova Scotia and in Prince Edward Island. Simon was well endowed by nature; he was strong of body, mind, and character. "What we now call school training, the pursuit of fixed studies at stated hours under the constant guidance of a teacher, I (Simon) could scarcely be said to have enjoyed. For the most part, when I attended my father's school at all, I came and went with entire freedom \* \* \*." Simon was precocious, and he appears to have been born with the conquering power of concentration of mind. Arithmetic was begun at the age of 5, and the study of geography at 6; and at  $6\frac{1}{2}$  years of age he was "pretty well through the arithmetic," not including cube root. While his age was still expressed in one digit, his father secured for him an old work on astronomy, concerning which the father late in life wrote to the son: "You were wonderfully taken with it, and read it with avidity. \* \* I one evening lectured on astronomy at home: the house was pretty well filled. \* \*

<sup>1</sup> Many items in this biography have been taken from Newcomb's autobiographical volume, The Reminiscences of an Astronomer; Houghton, Mifflin & Co., 1903. 1 you were not quite 10 years old \* \* \*. Almost as soon as I was done you said, 'Father, I think you were wrong in one thing.'"

John Newcomb wrote further to his son, "You were an uncommon child for truth. I never knew you to deviate from it in one instance. \* \* \* You were uncommonly deficient in that sort of courage necessary to perform bodily labor. Until 9 or 10 years of age you made a most pitiful attempt at any sort of bodily or 'handy' work." To understand the local point of view as to manual labor, we should note that the great majority of Newcomb's neighbors were poor. The men and boys worked long hours, tilling the ground, and cutting lumber, wood, and stone for export. The women and girls sheared the sheep, spun the yarn, wove the homespun cloth, and made the clothes.

The father's letter to the son continues:

I now often impressed upon you the necessity of bodily labor, that you might attain a strong and healthy physical system, so as to be able to stand long hours of study when you came to manhood, for it was evident to me that you would not labor with the hands for a business. On this account, as much as on account of poverty, I hired you out for a large portion of the three years that we lived in Clements.

At 15 you studied Euclid and were enraptured with it. It is a little singular that all this time you never showed any self-esteem, or spoke of getting into employment at some future day, among the learned. The pleasure of intellectual exercise in demonstrating or analyzing a geometrical problem, or solving an algebraic equation, seemed to be your only object. \* \* \*

Your almost intuitive knowledge of geography, navigation, and nautical matters in general caused me to think most ardently of writing to the admiral at Halifax to know if he would give you a place among the midshipmen of the Navy; \* \* \*.

Simon's studies in algebra, in Euclid, and in navigation (from books found in his grandfather's house) were pursued eagerly and without the advice of an instructor. Newcomb says of his studies in geometry: "A new world of thought seemed to be opened. That principles so profound should be reached by methods so simple was astonishing. I was so enraptured that I explained to my brother Thomas, while walking out of doors one day, how the Pythagorean proposition, as it is now called, could be proved from first principles, drawing the necessary diagrams with a pencil on a piece of wood."

At the age of 16 it was necessary for Simon to think of earning a livelihood and to decide upon a trade or profession. He has written of his problem: "The skill required on a farm was above my reach, where efficiency in driving oxen was one of the most valued of accomplishments. I keenly felt my inability to acquire even respectable mediocrity in this branch of the agricultural profession. \* \* \* I had indeed gradually formed, from reading, a vague conception of a different world—a world of light—where dwelt men who wrote books, and people who knew men who wrote books, where lived boys who went to college and devoted themselves to learning, instead of driving oxen. I longed much to get into this world, but no possibility for doing so presented itself. I had no idea that it would be imbued with sympathy for a boy outside of it who wanted to learn."

Circumstances now led Simon to apprentice himself to a physician of Moncton, New Brunswick, who had the reputation of effecting wonderful cures. The contract was to terminate when Simon should reach the age of 21, at which date he was to be a practicing physician. Simon soon found that he was dealing with a dishonest quack who made the apprentice his drudge and gave nothing in recompense. After long consideration, he cut the knot by "running away," on September 13, 1853. Walking more than 50 miles from before daylight till late at night, and more than 30 miles the following day, he arrived in St. John on the evening that the beginning of work on the first railway in New Brunswick was being celebrated. Another week of struggle with the question of a bed by night and a loaf of bread by day brought him across the international boundary line to the village of Calais, in Maine. Here he contracted with the captain of a small sailing vessel for the passage to Salem, 15 miles north of Boston, for all the money Simon had—one or two dollars—and his help on the voyage. The short trip consumed about three weeks. At Salem he was met by his father, who, after the death of Simon's mother at the early age of 37, had sought his fortune in "The States." The father had decided, for some reason, to locate in the eastern part of Maryland; and here, at the beginACADEMY OF SCIENCES.] No. 1.]

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ning of 1854, Simon Newcomb began his distinguished educational career, as the teacher of a country school at Masseys Cross Roads, Kent County. The following year he secured a somewhat better position as teacher of the school in the little town of Sudlersville. Newcomb valued then and later a letter from the trustees of the Sudlersville school, which reads as follows:

This is to certify that Mr. Simon Newcomb was well qualified to instruct children in the various branches of an English education, and possesses a good moral character. He exhibited a very considerable knowledge of the higher branches of mathematics.

W. J. SUDLER, JOHN W. E. SUDLER, Trustees for Primary School No. 4 of Q. A. Co., for the year ending 1855.

(Dated) SUDLERSVILLE, November 23, 1855.

Quoting from Newcomb's Reminiscences: "In 1854 I availed myself of my summer vacation to pay my first visit to the National Capital, little dreaming that it would ever be my home. I went as far as the gate of the observatory, and looked wistfully in, but feared to enter, as I did not know what the rules might be regarding visitors. I speculated upon the possible object of a queer red sandstone building, which seemed so different from anything else, and heard for the first time of the Smithsonian Institution."

While teaching, Newcomb passed every spare hour on such books as he could secure or gain access to. He had, in the meantime, decided that mathematics was the study in which he should specialize, though he did not see clearly how he could turn the results to account.

Newcomb's first published paper is of interest from many points of view. A correspondent of the newspaper, the National Intelligencer, wrote a long letter to refute the Copernican theory of the universe. Newcomb has said of this letter: "It was evidently wholly fallacious, yet so plausible that I feared the belief of the world in the doctrine of Copernicus might suffer a severe shock, and hastened to the rescue by writing a letter over my name, pointing out the fallacies. This was published in the National Intelligencer in 1855."

In 1856 Newcomb was employed as a tutor in the family of a planter residing in Prince Georges County, Md., some 15 or 20 miles from Washington. He frequently rode on horseback to the Capital, which contained much to interest him. The library of the Smithsonian Institution was a great attraction, and there he found Bowditch's translation of Laplace's Méchanique Céleste, a great work of which he had long been dreaming. He secured Prof. Joseph Henry's special permission to take the first volume home. Newcomb dipped into it here and there, but found its formulæ and methods quite beyond his powers at that time.

A little later he had the pleasure of meeting Joseph Henry, who suggested that he might find something to do in the Coast Survey. Newcomb established friendly relations with the chief clerk of the survey, and on one occasion proposed to the clerk a plan for improving the Cavendish method of determining the density of the earth. Later he was received by Mr. J. E. Hilgard, assistant in charge of the survey. An opportunity for service in the Coast Survey did not present itself, but late in the year 1856 Hilgard wrote a letter to Newcomb to say that he had been talking about Newcomb to Prof. Winlock, superintendent of the American Ephemeris and Nautical Almanac, and that it might be possible for Newcomb to obtain employment in the Almanac office. Newcomb had previously bought a copy of the Almanac and had amused himself by computing on a slate the occultations of stars by the moon observable in certain months at San Francisco. The Almanac office was then located in Cambridge, Mass., and about the last day of the year 1856, armed with letters of recommendation from Prof. Henry and Mr. Hilgard, Newcomb started on the tedious journey thither, in the hope that employment would be offered. A few weeks later he was appointed a computer, on trial, at a salary of \$30 per month. Newcomb's impressions of Prof. Henry and Mr. Hilgard, and of Prof. Winlock and others employed in the Almanac office, were fully up to his boyhood conception of men of science, and he has written: "I date my birth into the world of sweetness and light on one frosty morning in January, 1857, when I took my seat between two well-known mathematicians (Joseph Winlock and John D. Runkle), before a blazing fire in the office of the 'Nautical Almanac,' at Cambridge, Massachusetts."

Newcomb's assigned duties in the Almanac office required only five hours a day, and he took advantage of the opportunity to enroll himself as a student of mathematics in the Lawrence Scientific School in Harvard College, where he pursued studies under the direction of Prof. Benjamin Peirce. He received the degree of bachelor of science in 1858. During his remaining three years in Cambridge he was on the rolls of Harvard College as a resident graduate.

Newcomb's contributions to mathematical astronomy began shortly following his appointment on the Nautical Almanac. His first paper, On a Method in Dynamics, was dated April 2, 1858, and was published in Gould's Astronomical Journal. Shortly thereafter he decided to investigate the famous and difficult hypothesis that the asteroids owe their origin to the explosion of one and the same antecedent body at some past epoch. If this was the case, then the orbits of the several pieces of the disrupted body passed through a common point at that epoch—the point occupied by the parent body at the instant of disruption. He read a paper at the Springfield meeting of the American Association for the Advancement of Science in 1859 on the changes in the orbit of one asteroid in several hundred thousands of years past. A month later he published similar information for three other asteroids, and in the spring of 1860 the final results of his extensive investigation were published in the Proceedings of the American Academy of Arts and Sciences, under the title, On the Secular Variations and Mutual Relations of the Asteroids. He concluded that, so far as our present theory of motion could show, the asteroids had never passed through a common point, and therefore the hypothesis was not tenable.

The Nautical Almanac office dispatched an expedition, in charge of Simon Newcomb and William Ferrel, to observe the total solar eclipse of July, 1860, at the point where the shadow path crossed the Saskatchewan River, north of Lake Winnipeg. The travel was arduous, and only at the cost of a severe struggle did the birch-bark canoes, propelled by Indians, carry them across Lake Winnipeg and up the Saskatchewan River in time to make hasty preparations for the observations. Unfortunately the sky was completely clouded at the time of the eclipse.

In August, 1861, Dr. B. A. Gould recommended to Newcomb that he apply for the vacant position of professor of mathematics in the United States Navy, for service in the Naval Observatory. The plan did not appeal strongly to Newcomb, as his tastes and talents were along the line of mathematical astronomy, in contradistinction to observational astronomy. Nevertheless, it was desirable to provide for the needs of the future, and he applied. The appointment was made by President Lincoln, and Newcomb reported to Capt. Gilliss, Superintendent of the Naval Observatory, on October 7, 1861. He was assigned to duty as assistant on the transit instrument, under Prof. Yarnall in charge. He and Yarnall alternated in observing right ascensions of the stars—such stars as each "thought best to observe." The mural circle at the other end of the building observed the declinations of such stars as the professor in charge of that instrument chose.

In the year 1863 Newcomb was placed in charge of the mural circle and of the prime vertical transit instrument. He then proposed to Supt. Gilliss that a homogeneity of observing program and method <sup>2</sup> should mark the work of the Naval Observatory, in place of the go-as-youplease policy previously followed by every member of the staff, and the superintendent was pleased to approve and adopt the suggestion. The new transit circle, ordered in Berlin for the Naval Observatory, arrived in 1865, and was placed in Newcomb's charge. He planned with great care a four years' program of "fundamental" observing; that is, a system of observing which rests upon its own foundations, as distinguished from the "differential" method, which assumes the correctness of, and is based upon, the results of earlier observations. He brought this program to completion in 1869. Discussion of the observations revealed, as he had expected, the presence of systematic errors in existing catalogues of star positions, and especially in their right ascensions, to the effect that the assigned right ascensions of the stars in one part of the sky were systematically too great, and in another part of the sky systematically too small. His observing program had been designed originally to detect such errors in the old catalogues and to eliminate them from his own work.

<sup>&</sup>lt;sup>2</sup> European practice, notably at the Royal Observatory, Greenwich, had suggested this to Newcomb.

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In the volumes of Astronomical and Meteorological Observations Made at the United States Naval Observatory, Washington, in the years 1861 to 1870, inclusive, one finds abundant evidence of Newcomb's great energy in using the instruments for which he was responsible, in reducing the observations and in the prompt publication of the results. The same volumes reveal his breadth of view and power, in a half dozen comprehensive papers, on the latitude and longitude of the United States Naval Observatory, on the distance of the sun and the elements which depend upon it, on the new transit instrument (a description), on the positions of fundamental stars deduced from Washington observations made between 1862 and 1867, on the right ascensions of the equatorial fundamental stars and the corrections necessary to reduce the right ascensions of different catalogues to a mean homogeneous system, etc.

Prof. Newcomb was detailed to observe the total eclipses of the sun at Des Moines, Iowa, in June, 1869; at Gibraltar in December, 1870; and at Separation, Wyo., in July, 1878.<sup>3</sup> He was especially interested in determining the relative positions of the sun and moon, as indicated by the times of the contacts of the lunar and solar images, by the durations of the eclipses, and (in Iowa and in Wyoming) by the observed north and south limits of the shadow path. The eclipses at Des Moines and at Separation were successfully observed, but the value of the Gibraltar expedition was largely destroyed by the presence of clouds during the critical parts of the eclipse period.

At about this time Prof. Newcomb realized that the discrepancies between the observed positions of the moon and the positions as predicted in Hansen's tables for the moon had become a serious matter, and at his request it was arranged that he should be relieved from the duty of making observations, and from other observatory work, in order to conduct an investigation of the moon's motion, though at the request of the superintendent he retained his position on the observatory staff. The lunar problem developed into the leading work of his life; it received his best efforts during many of the years 1870 to 1909.

The devoting of the resources of the Naval Observatory to the determination of star positions and to the special needs of the Navy Department led naturally to the neglect of that side of astronomical investigation which requires powerful telescopes. This fact was called to the attention of the superintendent of the observatory by Prof. Newcomb in 1868, and again in 1869, with the recommendation that the observatory procure a refracting telescope as large as the then celebrated maker, Alvan Clark, would undertake to construct. These recommendations led ultimately to the appropriation of \$50,000 for the purpose by the Congress of 1870-71. It was decided by Mr. Clark and the observatory authorities that the telescope should be a refractor of 26-inch aperture. Prof. Newcomb tested the object glass in Cambridge in the summer of 1873, and the records show that the first observations made with the telescope finished and mounted in the Naval Observatory were of Neptune's satellite, by Newcomb, on November 20, 1873. He remained in charge of the instrument until May, 1875. In that period he made many measures of the positions of the satellites of Uranus and Neptune, as a basis for determining more accurately the masses of the two planets, in order to facilitate his work of reconstructing the tables of the motions of the planets; many observations of the satellites of Saturn; and a few observations of occultations and of double stars.

Prof. Newcomb was prominently associated with the plans for observing the transits of Venus over the sun in the years 1874 and 1882, to obtain an improved value of the distance between the earth and the sun. He inaugurated the proposal at the April, 1870, meeting of the National Academy of Sciences—the first annual meeting following his election to membership—by reading a paper <sup>4</sup> concerning the coming transits, and by introducing a resolution calling for the appointment of a committee to consider and report upon the subject. This resulted, in 1871, in the establishment of the Transit of Venus Commission, of five members, including Prof. Newcomb and Prof. Harkness. Newcomb was elected secretary of the commission. The commission gave to the subject the serious consideration demanded by its character

<sup>&</sup>lt;sup>8</sup> At this time Newcomb was superintendent of the Nautical Almanac and not officially connected with the Naval Observatory, but the expedition was under the auspices of the Observatory and the report upon the observations was addressed to the Superintendent of the Naval Observatory.

<sup>•</sup> On the Mode of Observing the Coming Transits of Venus, Amer. Jour. Sci. and Arts, 50, 74-83, 1870.

and difficulties, and after experiment and trial proposed the following modifications of or additions to the more or less conventional program:

1. The observations should be made with a photographic telescope, of long focus, whose collimation axis should lie in the intersection of a horizontal plane and the plane of the meridian.

2. A plumb line, consisting of very fine wire, should be suspended in front of the photographic plate, and as nearly as possible in contact with it, to form upon the plate a truly vertical line to serve all purposes of orientation.

3. Means should be provided to determine accurately the distance and any changes of distance between the object glass of the telescope and the photographic plate throughout the observation period.

Prof. Newcomb, as secretary and member of the commission, bore a prominent part in the preparation of a series of three papers relating to the transit of Venus in 1874, as a guide and help to the observers, writing the first, On the Application of Photography to the Observation of the Transits of Venus, and the third, On the Corrections to Hansen's Tables of the Moon's Motion, needed in determining the longitudes of isolated observing stations.

Plans for observing the transits of Venus were made also by the astronomers of Great Britain, France, Germany, Denmark, Russia and Italy. Coöperation amongst the parties from the different countries promised to be generally helpful, and with that policy in mind Newcomb accepted an invitation to attend a meeting of the German commission, in Hanover, in 1873. He endeavored to make clear the views of the American commission that valuable results could not be secured by the system of photographing which had been proposed, but the response was that the preparations had been advanced too far to admit of starting on a new plan.

The Congress appropriated a total of \$175,000 in the years 1872, 1873, and 1874 to finance the program of the American commission. Expeditions were dispatched to three northern stations, in China, Japan, and Siberia, and to five southern stations. Unfavorable weather prevailed at all of the stations; failure from clouds was not complete at any station, but the value of the observations at every station was impaired. The results for the sun's distance obtained by the commissions from the various countries were disappointing even where the skies were clear. Newcomb was convinced that a better value for the radius of the earth's orbit could be obtained by determining as accurately as possible the velocity of light and the time which light requires to travel from the sun to the earth. He questioned seriously whether our Government would be justified in dispatching parties to observe the transit of Venus in 1882. The astronomers of this country were consulted, but only two negative voices, those of Newcomb and Pickering, were heard. The commission secured an additional appropriation of \$85,000, and proceeded with the plans for observing the second transit. Prof. Newcomb conducted the expedition to the Cape of Good Hope, where the sky on the day of the transit was perfect and the observations were made as planned. Clear skies prevailed at about half of the stations—four southern and five northern— and none of the observing parties failed completely.

It was a matter of sincere regret to Prof. Newcomb that the results of the American observations have remained substantially unpublished. A preliminary discussion of some of the observations of 1874 made under the direction of the commission and edited by Newcomb, appeared in 1880; but concerning the 1882 transit, nothing seems to have been published except brief statements in an annual report of the Naval Observatory. Prof. Newcomb, as secretary of the commission, was charged with the duty of reducing the observations and of preparing them for the press. Small appropriations for assistants in this work had been made by the Congress, but in the assignments of the reappropriations there were several slips, apparently beyond Prof. Newcomb's control. The computers were discharged for lack of funds a first time, a second time, and eventually a third time. Shortly thereafter, apparently in 1882, all of the transit of Venus papers and results were turned over to Prof. Harkness, who reported progress during a dozen succeeding years. Prof. Newcomb has recorded the opinion that the work is "in that condition known in household language as 'all done but finishing.' Whether it will ever appear is a question for the future." It is probable that all the men who ever had any responsibility for, or serious knowledge of, the subject have passed away. In one sense, the

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lack of definite published results is exceedingly unfortunate. In another sense, their nonappearance may not be a serious matter, inasmuch as the transit of Venus method of determining the quantity sought has been superseded by incomparably better methods.

Prof. Newcomb rendered exceedingly valuable service in connection with several of the world's great telescopes. His relations to the Lick Observatory were particularly interesting. Shortly after James Lick had provided for the construction of a telescope "superior to and more powerful than any telescope ever yet made," the president of Mr. Lick's first board of trustees, Mr. D. O. Mills, visited Washington (in the summer of 1874) to confer with the Government astronomers, and chiefly with Prof. Newcomb, as to the kind and size of telescope which the trustees should endeavor to secure. At Mr. Mills's request Newcomb visited the leading European telescope makers, in order to determine whether it was advisable to look beyond the firm of Alvan Clark & Sons in seeking to make a contract. His report to the trustees, bearing the date March 4, 1875, discouraged the trustees from further consideration of European opticians. It was on the occasion of Mr. Mills's first visit to Washington that Prof. Newcomb recommended strongly the advisability of selecting a director for the Lick Observatory, and suggested that Prof. Holden, then Newcomb's assistant on the 26-inch equatorial, might be well qualified. In 1876 Capt. Floyd, the president of Lick's third board of trustees, which finally built the observatory, consulted in Washington with Prof. Newcomb, and it was at the suggestion of Profs. Newcomb and Holden that Mr. Burnham went to Mount Hamilton in 1879 as an expert to test the atmospheric conditions prevailing there. However, this was after Mr. Lick had definitely selected Mount Hamilton as the site of his observatory, and after the county authorities had completed a splendid road to the summit on that condition. It was too late to change the location, but fortunately Burnham's report was enthusiastically favorable.

At Capt. Floyd's request, Profs. Newcomb and Holden suggested plans for the positions and the principal features of the main buildings of the Lick Observatory, and these plans were followed in a general way. Newcomb and Floyd inspected the mounting for the 36-inch Lick refractor in the shops of the builders, Warner & Swasey, Cleveland, Ohio, in 1887. Newcomb continued to take a lively interest in the Lick Observatory and its work to the end of his life.

It is not impossible that the successful construction of the 26-inch Washington telescope was responsible for James Lick's idea and decision to provide for the construction of a larger telescope. Extensive descriptions of the Washington instrument were published in the leading American newspapers at the time of its completion, and an associate of James Lick has told me that he saw scattered about Lick's living room the copies of a large number of American newspapers which contained these descriptions.

When Otto Struve, director of the great Russian observatory at Poulkovo, informed Prof. Newcomb in 1878 that he was arranging with his Government for a grant of money to construct a great refracting telescope, Newcomb called his attention to the ability and success of Alvan Clark & Sons in making large object glasses. Struve's efforts to obtain a suitable object glass from European opticians were fruitless, and he came to the United States in 1879 to make a contract with the Clarks. Prof. Newcomb, as a friend of both parties, took a prominent part in the negotiations. It was chiefly in appreciation of these services that the Czar of Russia, in 1889, presented to Prof. Newcomb a rare vase of jaspar bearing the inscription: "A Monsieur le Professeur Simon Newcomb de la part de l'Observatoire Central Nicolas de Poulkovo 7/19 Aôut, 1889."

The lunar investigations and tables by Hansen, to which we have referred, published by the British Government in 1857, were based on a few of the Greenwich observations of the moon made between 1750 and 1850. Observations prior to 1750, so far as they seemed to be available, were thought to be too inexact for the purpose. Newcomb considered it very probable that many unpublished observations of occultations of bright stars by the moon prior to 1750 were recorded in astronomers' notebooks on file in the European observatories.

A few occultations, published in the Memoirs of the French Academy and in the Philosophical Transactions, made between the years 1660 and 1700, showed that Hansen's tables, carried back to that period, were much in error, and the importance of making a search for

unpublished observations was evident. The solar eclipse of December, 1870, took Newcomb to Gibraltar, and, as soon as the siege of Paris was raised he instituted an exhaustive search for unpublished occultations amongst the records of the Paris Observatory, with results beyond his liveliest expectations. The observations that he wanted had been made in great numbers both at the Paris Observatory and at other points in the city of Paris. The work of copying the observational data, and of familiarizing himself with the methods of the astronomers in making them, consumed six weeks. Newcomb estimates the value of these observations thus: "The material I carried away proved the greatest find I ever made. Three or four years were spent in making all the calculations \* \* \*. Seventy-five years were added, at a single step, to the period during which the history of the moon's motion could be written. Previously this history was supposed to commence with the observations of Bradley, at Greenwich, about 1750: now it was extended back to 1675, and with a less degree of accuracy 30 years further still. Hansen's tables were found to deviate from the truth, in 1675 and subsequent vears. to a surprising extent. \* \* \* During the time I was doing this work, Paris was under the reign of the Commune and besieged by the national forces. The studies had to be made within hearing of the besieging guns." The results of the investigations were published 5 by Newcomb in 1878.

President Eliot, of Harvard College, offered the directorship of the Harvard College Observatory to Prof. Newcomb in 1875. After due consideration the offer was declined, because, in his opinion, he was better fitted to conduct the work already started in Washington than to direct an observing institution; and there was the further factor that the position of superintendent of the American Ephemeris and the Nautical Almanac would become vacant automatically in two years, and here, as Newcomb expressed it, "would be an unequaled opportunity for carrying on the work in mathematical astronomy I had most at heart." Newcomb has further commented that "no one who knows what the Cambridge Observatory has become under Prof. Pickering can feel that Harvard has any cause to regret my decision."

In due time Prof. Newcomb was appointed Superintendent of the Nautical Almanac. He assumed this duty on September 15, 1877. "The change was one of the happiest of my life. I was now in a position of recognized responsibility, \* \* \* where I could make plans with the assurance of being able to carry them out \* \* \*. The program of work which I mapped out, involved, as one branch of it, a discussion of all the observations of value on the positions of the sun, moon, and planets, and incidentally on the bright fixed stars, made at the leading observatories of the world since 1750. One might almost say it involved repeating, in a space of 10 or 15 years, an important part of the world's work in astronomy for more than a century past. Of course, this was impossible to carry out in all its completeness. In most cases what I was obliged practically to confine myself to was a correction of the reductions already made and published. Still, the job was one with which I do not think any astronomical one ever before attempted by a single person could compare in extent. The number of meridian observations on the sun, Mercury, Venus, and Mars alone numbered 62,030. They were made at the observatories of Greenwich, Paris, Konigsberg, Poulkovo, Cape of Good Hope, but I need not go over the entire list, which numbers 13. The other branches of the work were such as I have already described—the computation of the formulae for the perturbation of the various planets by each other." A fuller and splendid statement of the nature of the great problem, a report of progress made to date, and an outline of plans ahead, were published by Newcomb in September, 1882, in Astronomical Papers of the American Ephemeris and Nautical Almanac, 1, VII-XIV, 1882.

Such enormous tasks could not, of course, be performed by any individual unaided. In the introduction to the volume just referred to Newcomb wrote: "Both Congress and the Navy Department have supplied all the assistance which has been asked for, and a force of from eight to ten computers, some of the highest order of mathematical ability, has been actively employed during the past year, and may, if necessary, be increased in the future." In his

<sup>5</sup> Researches on the Motion of the Moon. Part I: Reduction and Discussion of Observations of the Moon before 1750. Washington Observations for 1875, Appendix II, pp. 1-280. 1878.

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reminiscences he has written generously of his chief assistants in the work of the Almanac office, and space should be taken for a few quotations:

Perhaps the most eminent and interesting man associated with me during this period was Mr. George W. Hill, who will easily rank as the greatest master of mathematical astronomy during the last quarter of the nineteenth century. \* \* \* The part assigned to Hill was about the most difficult in the whole work—the theory of Jupiter and Saturn Owing to the great mass of these "giant planets," the inequalities of their motion, especially in the case of Saturn, affected by the attraction of Jupiter, are greater than in the case of the other planets. Leverrier failed to attain the necessary exactness in his investigation of their motion.

Hill had done some work on the subject at his home in Nyack Turnpike before I took charge of the office. He now moved to Washington, and seriously began the complicated numerical calculations which his task involved. I urged that he should accept the assistance of less skilled computers; but he declined it from a desire to do the entire work himself. Computers to make the duplicate computations necessary to guard against accidental numerical errors on his part were all that he required. He labored almost incessantly for about 10 years, when he handed in the manuscript of what now forms Volume IV <sup>6</sup> of the Astronomical Papers. \* \* \* And here was perhaps the greatest living master in the highest and most difficult field of astronomy, winning world-wide recognition for his country in the science, and receiving the salary of a department clerk. I never wrestled harder with a superior than I did with Hon. R. W. Thompson, Secretary of the Navy, about 1880, to induce him to raise Mr. Hill's salary from \$1,200 to \$1,400. It goes without saying that Hill took even less interest in the matter than I did. He did not work for pay, but for the love of science. \* \* \* That I could not secure for him at least the highest official consideration is among the regretful memories of my official life.

Of John Meier he says:

He was the most perfect example of a mathematical machine that I ever had at command.

Of Cleveland Keith:

A man of totally different blood, the best in fact, entered the office shortly before Meier broke down. This was Mr. Cleveland Keith, son of Prof. Reuel Keith, who was one of the professors at the observatory when it was started. His patience and ability led to his gradually taking the place of a foreman in supervising the work pertaining to the reduction of the observations, and the construction of the tables of the planets. Without his help, I fear, I should never have brought the tables to a conclusion.

In 1894 I had succeeded in bringing so much of the work as pertained to the reduction of the observations and the determination of the elements of the planets to a conclusion. So far as the larger planets were concerned, it only remained to construct the necessary tables, which, however, would be a work of several years.

The program was now interrupted by new duties assumed in connection with placing the nautical almanacs of the different nations upon a homogeneous basis, in accordance with plans and decisions made by the heads of the various almanac offices, at a conference in Paris in May, 1896. It later transpired that some of the leading American astronomers were unwilling to approve, adopt, and abide by these decisions, and the full fruits of the plan were not realized in the American Ephemeris. The subject was further complicated by the automatic retirement of Prof. Newcomb on completing his sixty-second year, March 12, 1897. It became a serious question whether he would be able to finish the international program, and also the planetary tables, after his successor should have assumed the duties of the Almanac office. An arrangement was eventually effected under which computers, provided for by a small congressional appropriation, "were not to be prohibited from consulting me in its prosecution."

Speaking of the Nautical Almanac office, Prof. Newcomb has written:

In conducting my office also, the utmost economy was always studied. The increase in the annual appropriations for which I asked was so small that, when I left the office in 1897, they were just about the same as they were back in the fifties, when it was first established. The necessary funds were saved by economical administration. All this was done with a feeling that, after my retirement, the satisfaction with which one could look back on such a policy would be enhanced by a feeling on the part of the representatives of the public that the work I had done must be worthy of having some pains taken to secure its continuance in the same spirit. \* \* \* The work which I most regretted to leave unfinished was that on the motion of the moon. As I have already said, this work is (in 1903) complete to 1750. The computations for carrying it on from 1750 to the present time were perhaps three-fourths done when I had to lay them aside. In 1902, when the Carnegie Institution was organized, it made a grant for supplying me with the computing assistance and other facilities necessary for the work, and the Secretary of the Navy allowed me the use of the old computations. Under such auspices the work was recommenced in March, 1903.

It is a matter for universal congratulation that Prof. Newcomb was able to complete the work of his great program on the motion of the moon, under the patronage of the Carnegie Institution of Washington, and to prepare the results for publication, less than a month before

<sup>6</sup> A New Theory of Jupiter and Saturn, by G. W. Hill.

his death. The monograph containing the results, published in 1913 as Volume IX, Part I, pages 1-249, Astronomical Papers of the American Ephemeris and Nautical Almanac, is entitled Researches on the Motion of the Moon, Part II. Part I had been published in 1878. Newcomb's final views concerning the lunar problems are summarized in his paper dated 1908, December 11, entitled Fluctuations in the Moon's Mean Motion, in *Monthly Notices R. A. S., 69,* 164-169, 1909, from which we quote:

With the aid of my assistant, Dr. Frank E. Ross, I have brought to a completion a study of the moon's mean motion based on observations having an extreme range in time of about 2,600 years. The data of observation are as follows:

1. The eclipses of the moon found in Ptolemy's Almagest, observed between B. C. 720 and A. D. 134.

2. Observations of eclipses by the Arabian astronomers, extending from 829 to 1004.

3. Observations of eclipses of the sun and of occultations of stars by the moon made by Gassendi, Hevelius, and others, from 1620 to 1680.

4. Observations of occultations of stars from 1670 until the present time.

The observations previous to 1750 were all worked up in my Researches on the Motion of the Moon, published in 1878. I have, however, subjected the results to a careful revision, and grouped them in a slightly different way from the former one. From and after 1680 the observations are of a fair degree of precision, but there are frequent gaps during the last half of the eighteenth century. The observations are fairly continuous since 1820.

Taken in connection with the recent exhaustive researches of Brown, which seem to be complete in determining with precision the action of every known mass of matter upon the moon, the present study seems to prove beyond serious doubt the actuality of the large unexplained fluctuations in the moon's mean motion to which I have called attention at various times during the past 40 years. \* \* \*

The feature of most interest is the great fluctuation with a period of between 250 and 300 years. I call this a fluctuation rather than an inequality because, in the absence of any physical cause for its continuance, there is no reason to suppose that it will continue in the future in accordance with the law followed in the past. \* \*

I regard these fluctuations as the most enigmatical phenomenon presented by the celestial motions, being so difficult to account for by the action of any known causes, that we can not but suspect them to arise from some action in nature hitherto unknown. \* \* \*

One general result of the present state of things is that we can not draw any precise conclusions from a discussion of the moon's motion in longitude, how refined soever we make it. For example, it is impossible to derive from observation the accurate coefficient of the 18.6-year nodal inequality in longitude, owing to the varying fluctuation.

It is also not possible to predict the future motion of the moon with precision. If we require our ephemerides of the moon's longitudes to be as exact as possible, we must correct the tabular mean longitude from time to time by observations.

It is not possible to give here an adequate impression of the immense labor involved in carrying to completion the programs of lunar and planetary investigations referred to in the preceding pages. In fact, a correct impression can not be gained even at the price of a careful perusal of the voluminous papers describing the results unless the reader himself has dipped into the complexities of gravitational astronomy and has had extensive experience in making astronomical calculations. It means relatively little to say that the work was of herculean and monumental proportions. Some of the investigations are described in the publications of the United States Naval Observatory, in the various astronomical journals, and in special mediums; but the theory and tables of the planetary and lunar motions are contained chieffy in the Astronomical Papers Prepared for the Use of the American Ephemeris and Nautical Almanac, of which eight and one-half large quarto volumes exist. These papers rank amongst the priceless treasures of astronomical literature.

G. W. Hill's theory of the motions of Jupiter and Saturn fills Volume IV, his tables for computing the motions of these planets occupy the first half of Volume VII, and three extensive papers by the same author are in other volumes of the series. Excepting, further, one paper by Safford and two papers by Michelson (on the velocity of light), the remainder of the series is made up of 25 extensive monographs by Newcomb. They treat of solar eclipses; of transits of Mercury and Venus; of a determination of the velocity of light; of the theories of the motions of Mercury, Venus, Earth, Mars, Uranus, and Neptune; of the constants of the orbits of these planets, and tables to assist in computing their future positions; of the mass of Jupiter; of the precession and nutation constants; of the development of the perturbative function; of the motion of the moon, etc. Included also are Newcomb's Catalog of 1098 Standard Stars (their definitive positions and proper motion), prepared to meet his own needs in reducing the already existing

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observations of the planets and the moon to a homogeneous system, and Newcomb's Catalogue of (1596) Fundamental Stars, reduced to an absolute system, to meet the needs of the almanacs of the different nations.

The need of a more accurate determination of the velocity of light was pointed out by Newcomb in 1867. He brought the subject before the National Academy in 1878, and in response to the academy's favorable report the Congress appropriated \$5,000 to defray the expense of the determination. The problem was assigned to Newcomb. He employed Foucault's method, with improvements and refinements. His principal observing stations were at the foot of the Washington Monument and at Fort Myer across the Potomac River. The distance between the mirrors at the two stations was 3,721.21 meters. The observations were conducted in the years 1880–1882, and they led to a concluded velocity of light in vacuo of 299,860 + 30 kilometers per second. Michelson's value, determined at Cleveland in 1882, was 299,853 kilometers per The percentage of error in these values is thought to be very small. Newcomb's second. value of the velocity, combined with Nyren's value of the constant of aberration, 0."492, led to a corresponding value of 8."794 for the solar parallax. Unfortunately the many values assigned to the aberration constant by the various investigators differ, for reasons as yet unexplained for the most part, and the related values for the solar parallax are correspondingly uncertain.

A condensed résumé of the investigations of the motions of Mercury, Venus, Earth and Mars, of the masses of these planets, of the constants of precession and nutation, of the solar parallax, of the mass of the moon, etc., was published in 1895 as a supplement to the American Ephemeris, under the title of The Elements of the Four Inner Planets and the Fundamental Constants of Astronomy. This useful volume contains also Newcomb's attempt to account for the outstanding discrepancies<sup>*a*</sup> of the motions of Mercury, Venus, the Earth and Mars, of which by far the most noteworthy is that concerning the perihelion of Mercury's orbit. He discusses the principal variations that would be produced in the motions of the planets by modifications in, or additions to, the forces normally considered, from the following sources:

1. An assumed nonsphericity of the sun.

2. An assumed intramercurial ring or group of planetoids.

3. The mass of the diffused matter which reflects the zodiacal light.

4. An assumed ring of planetoids between the orbits of Mercury and Venus.

5. A minute deviation of the law of gravitation from the exact inverse squares of the distances.

He concludes, in effect, that all of these assumptions are untenable.

What we may call Newcomb's minor contributions to astronomical knowledge were numerous. We take space to describe a few of them.

Euler's investigation of the motions of the earth had led to the result that if the axis of rotation does not coincide with the axis of the earth's spheroidal figure there must be a minute variation of terrestrial latitudes in a period of 10 months. Several able astronomers searched unsuccessfully for evidence of such a variation in existing observations. Küstner's observations at the Berlin Observatory in the eighties pointed unmistakably to a latitude variation. This led Chandler to institute an exhaustive study of the Greenwich and other observations, which established the existence of minute latitude variations with a principal period of about 14 months. Newcomb retraced Euler's steps, and confirmed his conclusion that an absolutely rigid and nondeformable earth would call for a period of 10 months, but deduced the new result that if the body of the earth were, on the average, only as rigid as steel, then Euler's period would be lengthened to 14 months, and thus be brought into close agreement with observation. Newcomb's investigation supplied, in fact, our first reliable determination of the earth's rigidity and his result has been substantially confirmed by the work of several observers on the tidal deformations of the solid earth and by the extensive series of observations on the transmission of earthquake waves through the earth's deep interior.

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<sup>•</sup> At the date of writing this biographical memoir (February, 1916) de Sitter's papers applying Einstein's theory of relativity to this problem had not yet been published. W. W. C.

The published descriptions of the zodiacal light had referred to it as an illumination, lenticular in form, extending east and west from the sun, but said little or nothing concerning the radius of the illumination in the north and south direction. It occurred to Newcomb that the latter constant could be determined by direct observation from a moderately high mountain summit correctly situated as to latitude and possessing transparent sky and unobstructed northern horizon. In the Northern Hemisphere the observations could best be made from points whose latitudes were such that the midnight sun would be only a little more than 18 degrees below the north point of the horizon, as this would eliminate the twilight effect and let the zodiacal illumination extend to its highest practicable altitude. Newcomb endeavored to make these observations from points in the White Mountains in several summers, but failed on account of imperfect atmospheric conditions. On a later trip to Switzerland he ascended the Brienzer Rothorn, altitude 7,700 feet, latitude 47°, with these observations in mind, and he was successful, on the nights of July 26 and 29, 1905. The zodiacal light arch was well seen and unmistakable, and it extended 35° north from the sun. A few years later these observations were repeated and Newcomb's results substantially confirmed by Fath at Mount Hamilton.

Newcomb's great program concerned the solar system, but his interests and contributions extended also to the stellar system. In 1902 he published an important volume on The Stars— A Study of the Universe. Its 20 chapters treat of such subjects as the proper motions of the stars, the parallaxes of the stars, double, triple and multiple star systems, the apparent distribution of the stars in the sky, the distribution of the stars in space, the structure of the Milky Way, the extent of the universe, etc.

Prof. Newcomb found time to write several admirable textbooks on astronomy. His Popular Astronomy, a comprehensive treatise of the fundamental principles of astronomy, issued in 1878, has perhaps never been equaled in merit by any other book aiming to cover approximately the same ground. Notwithstanding the tremendous advances of the past 40 years in astronomical science, the original edition remains a book which all students of astronomy could read with profit and pleasure. It has passed through several editions in this country and it has been translated into half a dozen foreign languages.

An excellent Astronomy for High Schools and Colleges, written by Profs. Newcomb and Holden, passed through several editions. The larger work was abridged for the use of schools.

Newcomb published a volume on Astronomy for Everybody, a Popular Exposition of the Wonders of the Heavens, in 1907, which was very successful. It has been translated into many languages. His Side-Lights on Astronomy and Kindred Fields of Popular Science, which appeared in 1906, reproduces 21 of his principal essays and addresses. His volume, A Compendium of Spherical Astronomy, published in 1906, treats admirably of the subjects which relate to the determination and the reduction of the accurate positions of the stars precession, nutation, aberration, proper motion, parallax, refraction, systematic errors of star catalogues, etc.

Newcomb possessed the power of writing for the intelligent public. Dozens of his articles on subjects of timely interest, admirably conceived and composed, appeared in Harper's Magazine, The Atlantic Monthly, McClure's Magazine, Popular Science Monthly, etc. He contributed frequently to The Nation, The New York Tribune, The Independent, The Youth's Companion, etc. Short articles and notes from his pen are numerous in Science. He wrote many of the articles on astronomical subjects in the leading encyclopaedias. He made notable addresses on occasions of great astronomical interest, such as the dedication of the Flower Observatory of the University of Pennsylvania, the Yerkes Observatory of the University of Chicago, and the Observatory of Syracuse University.

Newcomb's interest in the progress of mathematics was strong throughout his life. While an assistant on the Nautical Almanac at Cambridge he contributed frequently, especially on the theory and practice of probabilities, to Runkle's Mathematical Monthly during the three years of its existence. He and W. P. C. Bartlett and T. H. Safford were the committee, appointed by the editors, to judge of the solutions offered for problems set by the Monthly, and to award prizes.

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An extensive, and what we might call a complete, series of mathematical textbooks for high school and college was written by Newcomb and issued by Henry Holt & Co. in the years 1881–1887. The series included algebras for schools and for colleges, the elements of geometry, the elements of plane and spherical trigonometry, logarithmic and trigonometric tables, the elements of analytics, and the elements of differential and integral calculus. The several editions and reprints through which the books passed are perhaps the best evidence of their success and value.

Prof. Newcomb was appointed professor of mathematics and astronomy in Johns Hopkins University in 1884. He lectured and conducted seminars on astronomy on two days per week until the requirements of the Government service made his resignation necessary, at the end of the year 1893. He was reappointed to the position in 1898 and retained it until 1900, but his duties during this later period were apparently advisory to the students of mathematics and astronomy, as he seems not to have conducted formal courses in these subjects. He was editor of The American Journal of Mathematics, published under the auspices of Johns Hopkins University, during the years 1885–1893 and 1899–1900, and a coeditor in the years 1878–79, 1894–1898 and from 1901 until his death. He was one of the first, and perhaps the first, to receive appointment as lecturer in Johns Hopkins University, in its opening year, 1876. In many of the early years of the university he served as an examiner in mathematics and economics.

That Newcomb's services to Johns Hopkins University were highly valued by the authorities of the institution is clear from the honors conferred upon him. In 1897 he was requested by the faculty and friends of the university to sit for a portrait, to be presented to the university. In 1900 the president of the university wrote, "with grateful recognition of the valued counsel you have given to this university since its organization, the academic council has unanimously recommended to the trustees that you be appointed emeritus professor of mathematics, and the board of trustees with like unanimity approve this recommendation." On February 22, 1901, the Sylvester prize of Johns Hopkins University, a handsome bronze medallion of the late Prof. Sylvester, was awarded in duplicate, the first copy to Lord Kelvin, and the second copy to Prof. Newcomb, "in recognition of his distinction and his service." In February, 1902, at the celebration of the twenty-fifth anniversary of the founding of Johns Hopkins University, the degree of doctor of laws was conferred upon Newcomb "in recognition of his preeminent attainments and important discoveries in science."

Prof. Newcomb was elected president of the American Mathematical Society for two successive terms, serving during the years 1897 and 1898. At the close of the first term he delivered a presidential address on "The Philosophy of Hyperspace."

Prof. Newcomb's contributions to the domain of pure mathematics were limited, necessarily, and the subjects which received his attention were chiefly those which are related more or less intimately to celestial mechanics and probabilities. There could be no question, however, of a great underlying mathematical ability. Prof. Cayley, the eminent mathematician, on presenting the gold medal of the Royal Astronomical Society to Prof. Newcomb in 1874, spoke of a memoir by Newcomb on the Théorie des perturbations de la Lune qui sont dues à l'action des planètes,<sup>7</sup> thus: "The memoir is, from the boldness of the conception and beauty of the result, a very remarkable one, and constitutes an important addition to theoretical dynamics."

In 1895 Newcomb was awarded the Astronomical Journal prize of \$400 "For the most thorough discussion of the theory of the rotation of the earth, with reference to the recently discovered variation of latitude."

In 1902 Newcomb was the delegate from the National Academy to the celebration of the centenary of the birth of Abel, in the University of Christiania. The degree of doctor of mathematics was conferred upon him on that occasion. He was one of the vice presidents of the Fourth International Congress of Mathematicians held in Rome in 1908, and one of the nine principal speakers. His interest in the trend of modern mathematical thought and in the improvements of ways and means for teaching mathematics was always keen.

<sup>7</sup> Liouville's Journal, 16, 321-368, 1871.

One of the books which received Newcomb's attention in his school-teaching days was Say's Political Economy, of which he has written: "It was quite a delight to see human affairs treated by scientific methods." His interest in economic questions seems never to have flagged. His writings on the subject are numerous, and many of them have been accorded high rank by leading economists. They include several volumes and a great many magazine articles on timely subjects. In 1865 appeared his first contribution, a volume of 220 pages, entitled A Critical Examination of our Financial Policy during the Southern Rebellion. The A, B, C of Finance, issued in Harper's Half Hour Series, 115 pages, bears the date 1877. His Principles of Political Economy, an extensive treatise of 548 pages, was published in 1885. A Plain Man's Talk on the Labor Question, 195 pages, came out in 1886. His contributions to the North American Review began in 1866 with a thoughtful article on Our Financial Future; and later articles considered such subjects as the let-alone principle in economics, national debts, the standard of value, the principles of taxation, science and government, our antiquated method of electing a President, etc. Other leading journals contain articles on life insurance, the silver question, the organization of labor, schools of political economy, etc. Newcomb was a lecturer on political economy in Harvard College in 1879–80. He was elected president of the Political Economy Club of America in 1887. The first prize, \$150, of two "citizenship prizes" offered by the Anthropological Society of Washington, was awarded to Newcomb in 1894 for his essay on The Elements Which Make Up the Most Useful Citizen of the United States. The indications are that if Newcomb had chosen economics for his chief field of endeavor he would have been in the front rank of modern economists.

There were many sides and angles to Newcomb's interests. He was the first president of the American Society for Psychical Research, in 1885–86. His position was not at all that of a believer or devotee, but rather that of the interested observer who wanted to know the truth. His experiences with the American society were apparently in harmony with his opinion of the work of the parent English society: "I could not feel any assurance that the (English) society, with all its diligence, had done more than add to the mass of mistakes, misapprehensions of facts, exaggerations, illusions, tricks, and coincidences, of which human experience is full."

Newcomb wrote instructively for the public on a great variety of subjects: The Mariner's Compass; Can We Make It Rain? The Outlook for the Flying Machine; The Fairyland of Geometry; Why We Need a National University; On Conditions Which Discourage Scientific Work in America; Law and Design in Nature; Evolution and Theology; Science and Immortality; etc. He was inclined to be skeptical as to a practical development of "heavier-than-air" flying machines. He called attention to the fundamental fact that an increase in the dimensions of airplanes would increase the dead weight as the cube, whereas the lifting power would increase only as the square, of the dimensions. Success in developing larger and larger airplanes would demand increasing driving power, other factors being equal, and he did not foresee the recent high development of internal-combustion engines which now fulfill this requirement.

Newcomb also found time to write fiction. He is the author of short stories on The Wreck of the Columbia, and on The End of the World, and of a volume entitled His Wisdom the Defender—a Story, in which airships resembling the Zeppelin type are successfully employed. Newcomb's skepticism as to the airplane did not extend to air vessels involving the balloon principle, in which the lifting power increases as the cube of the dimensions and the resistance increases only as the square. In His Wisdom the Defender, Newcomb makes the hero dominate the earth by means of machines which fly at great heights above the earth and at great speeds, and use his power to disarm the standing armies and navies of the nations. "The greatest day in the history of the world, if I can bring it about, will be that when war shall have ceased forever, armies and navies exist no longer, and universal peace reign over all the nations."

The commanding position in astronomical science attained by Prof. Newcomb is accurately indicated by the long list of honors conferred upon him. In the number and the character of the learned societies in which he held honorary memberships, and in the number of honorary degrees conferred upon him, Newcomb stood alone in America, and in a very small company in the world. He was elected to membership in societies, not including many minor and local societies,<sup>8</sup> as below:

1859: Member American Association for the Advancement of Science. He was made a Fellow in 1874, and was elected president of the American association in 1876. He delivered the presidential address in 1878.

1860: Fellow American Academy of Arts and Sciences.

1869: Member National Academy of Sciences. He was vice president of the academy in 1883–1889, home secretary in 1881–1883, and foreign secretary from 1903 until his death.

1870: Associate Fellow American Academy of Arts and Sciences.

1871: Member Philosophical Society of Washington. He was president of the society for the years 1879, 1880, and 1909.

1872: Foreign Associate Royal Astronomical Society of London.

1873: Member Astronomische Gesellschaft. He was elected a member of the council of the Gesellschaft in 1887.

1874: Corresponding member Paris Academy of Sciences.

1875: Foreign Associate Royal Academy of Sciences, Stockholm.

1875: Corresponding member Imperial Academy of Sciences, Petrograd.

1876: Corresponding member Royal Academy of Sciences, Munich.

1877: Foreign Associate Royal Scientific Society of Upsala, Sweden.

1877: Foreign member Royal Society of London.

1878: Member American Philosophical Society, Philadelphia.

1878: Foreign member Holland Society of Sciences, Haarlem.

1878: Honorary member Cambridge Philosophical Society, England.

1881: Honorary Foreign Fellow Royal Society of Edinburgh.

1881: Foreign member Royal Physiographical Society, Lund, Sweden.

1882: Honorary member Royal Irish Academy, Dublin.

1883: Corresponding member Royal Academy of Sciences, Berlin.

1884: Corresponding member British Association for the Advancement of Science. He was

one of the vice presidents of the association in 1904.

1886: Honorary member London Mathematical Association.

1886: Associate Liverpool Astronomical Society.

1887: Honorary member Manchester Literary and Philosophical Society.

1888: Foreign correspondent Royal Society of Sciences, Gottingen.

1891: Honorary member New York Academy of Sciences.

1891: Honorary member Royal Institution of Great Britain.

1891: Honorary Fellow Royal Astronomical Society of Canada.

1891: Foreign Associate Royal Academy of Science, Brussels.

1895: Foreign Associate Institute of France.

1895: Foreign Associate Royal Academy of the Lincei, Rome.

1896: Honorary member Imperial Academy of Sciences, Petrograd.

1896: Officer of the Legion of Honor, France.

1897: Corresponding member Imperial Geographical Society, Petrograd.

1897: Foreign Associate Italian Society of Science, Rome.

1897: Honorary member Royal Society of Arts, London.

1898: Foreign Associate Royal Institute of Science, Letters and Arts, Venice.

1898: Honorary member Royal Academy of Sciences, Amsterdam.

1899: Corresponding member Royal Institute of Science and Letters, Milan.

1899: Foreign correspondent Bureau of Longitudes, Paris.

1901: Honorary member Russian Astronomical Society.

1901: Honorary member Royal Society of New South Wales, Sydney.

<sup>8</sup> For references to Newcomb's membership in many minor societies and academies I am indebted to Prof. R. C. Archibald's list published in *Tran. Roy. Soc., Canada,* sec. 3, for 1905, p. 79, and to his manuscript extending the list from 1905 to 1909 kindly lent me. (Archibald's list was later published in *Science*, 44, 871-878, Dec. 22, 1916.)

1902: Honorary member Astronomical Society of Mexico.

- 1904: Corresponding member Royal Academy of Science, Vienna.
- 1905: Corresponding member Royal Academy of Science, Turin.
- 1905: Corresponding member National Institute of Geneva, Switzerland.
- 1905: Knight of the Order Pour le Mérite for Sciences and Arts, Prussia.
- 1906: Honorary member Royal Academy of Sciences, Letters and Arts, Padua.
- 1907: Commander of the Legion of Honor, France.
- 1907: Honorary Fellow Physical Society, London.
- 1907: Foreign member Society of Sciences, Christiania.
- 1907: Foreign member Royal Society of Sciences, Gottingen.

Honorary degrees were conferred upon Prof. Newcomb as follows:

1874: LL. D., Columbian University (now George Washington University), Washington, D. C.

1875: Master of Mathematics and Doctor of Natural Philosophy, University of Leyden, on the third centenary of its founding.

1875: LL. D., Yale College.

1884: LL. D., Harvard College.

1886: Ph. D., University of Heidelberg, on the fifth centenary of its founding.

1887: LL. D., Columbia College, N. Y.

1891: LL. D., Edinburgh University.

1892: Sc. D., Dublin University, on the third centenary of its founding.

1892: Ph. Nat. D., University of Padua on the third centenary of the appointment of Galileo as a professor in the university.

1896: LL. D., Glasgow University.

1896: Sc. D., Cambridge University.

1896: LL. D., Princeton University, on the sesqui-centenary of its founding.

1899: D. C. L., Oxford University.

1900: LL. D., University of Cracow, on the fifth centenary of its founding.

1902: LL. D., Johns Hopkins University, on the twenty-fifth anniversary of its founding.

1902: Math. D., University of Christiania, on the first centenary of the birth of Abel.

1904: LL. D., University of Toronto.

Prof. Newcomb was awarded the following prizes and medals:

1874: The gold medal of the Royal Astronomical Society for his "researches on the orbits of Neptune and Uranus and for his other contributions to mathematical astronomy."

1878: The Huyghens gold medal of the Holland Society of Science, Haarlem, awarded biennially "to the individual who, by his researches and discoveries or inventions during the previous 20 years, had, in the judgment of the society, distinguished himself in an exceptional manner in a particular branch of science."

1890: The Copley medal of the Royal Society for contributions to gravitational astronomy.

1894: The first prize, \$150, of two citizenship prizes of the Anthropological Society of Washington, for his essay on "The elements which make up the most useful citizen of the United States."

1895: The Astronomical Journal prize of \$400, "For the most thorough discussion of the theory of the rotation of the earth, with reference to the recent discovery of the variation of latitude."

1897: The Schubert prize (900 roubles) of the Imperial Academy of Sciences, Petrograd, for notable advances made in mathematical astronomy.

1897: The Bruce gold medal of the Astronomical Society of the Pacific, in recognition of his services to astronomy—the first award of the medal.

1901: The Sylvester prize of Johns Hopkins University, a bronze medallion of Prof. Sylvester, "In recognition of his distinction and his service."

Many items of services rendered or honors received, additional to or in amplification of foregoing references, should be mentioned.

Newcomb was a member of the National Academy committee to arrange the program of observations for the total solar eclipse of May, 1883. He was one of the academy's three delegates to the Wiesbaden Conference of 1899 which led to the organization of the International Association of Academies. He was the academy's delegate to the meeting of the Council of the International Association of Academies held in London in 1903. He was a member of the academy committee on weights, measures, and coinage. He was a member of the academy committee which the Government authorities had requested to consider a report "upon the surveys of a scientific character made under the auspices of the War and Interior Departments and the Land Office." He was chairman of the academy advisory committee on meteorology, appointed in 1881. He was a member of the academy committee, appointed in 1886, to consider and report on the work of the scientific bureaus of the Government, with the view of securing greater efficiency and economy of administration. He was a member of the academy committee, in 1884, to assist the customs department in arriving at the correct interpretation of the expression, "philosophical and scientific apparatus, instruments, and preparations."

Newcomb was one of the three members of the National Academy named in the will of Prof. J. C. Watson to administer, with the academy's approval, the income of the Watson Fund, in which service he was active from 1881 until his death. He was chairman of the board of trustees of the Watson Fund from 1887 to 1909. In this interval the Watson Fund supported various minor researches and financed the laborious and highly skilled investigations on the motions of the Watson asteroids made by Prof. Leuschner; and the Watson gold medal of the academy was awarded to B. A. Gould (1887), Edward Schönfeld (1889), Arthur Auwers (1891), S. C. Chandler (1894), and Sir David Gill (1899).<sup>9</sup> This list of medalists is conspicuous by the absence of Newcomb's name; a regrettable omission, presumably due to the fact that he was chairman of the board of trustees, which governed the making of the awards.

Newcomb was president of the American Association for the Advancement of Science. in 1877. He was the first president of the Astronomical and Astrophysical Society of America (now the American Astronomical Society), founded in 1899, and was reelected president annually until 1905, when he requested and insisted on relief from the duty. He was president of the International Congress of Arts and Science at the Universal Exposition, held at St. Louis in 1904, where he delivered the introductory address, at the opening session, on The Evolution of the Scientific Investigator. His influence was potent in the selection of the great number of speakers from this and other countries who were invited to address the St. Louis congress, and he made a special trip to Europe in 1893 to secure the coöperation of the leading European men of science. He was elected a member of the board of overseers of Harvard University for the period 1906–1912. His portrait was painted in 1887, in compliance with the request of the Czar of Russia, for placing in the gallery of famous astronomers, in the Poulkovo Observatory. The University of Tokyo, in 1888, presented him with a pair of bronze vases of great beauty and value. He was elected one of the eight foreign associates of the Paris Academy of Sciences in 1895, to succeed von Helmholtz, Benjamin Franklin having been the only other native American to hold this appointment. He was a member of the first advisory committee on astronomy in the Carnegie Institution, in 1902-3, and thereafter a research associate in the institution. Grants of money in support of his researches on the moon were made each year by the institution. Newcomb was the first to receive the Bruce gold medal of the Astronomical Society of the Pacific, in 1897. The rules of award make this medal international in character; the directors of six observatories, Berlin,\* Greenwich, Harvard, Lick, Paris, and Yerkes, nominate a limited number of astronomers worthy to receive the medal, and the directors of the society must select the nominee from this list. The president of the society, in awarding the first medal, said, "One name stood forward so prominently in the nominations from the heads of six leading observatories of the world that the directors of this society could but set the seal of their approval upon the verdict of his peers and award the first Bruce medal to Prof. Simon Newcomb."

<sup>&</sup>lt;sup>9</sup> Note added in 1917: The sixth award of the Watson medal was made in 1917, to A. O. Leuschner.

<sup>\*</sup>Cordoba was substituted for Berlin in 1919.

On August 4, 1863, Prof. Newcomb married Miss Mary Caroline Hassler, daughter of Dr. C. A. Hassler, United States Navy, and granddaughter of Ferdinand R. Hassler, the founder and first superintendent of the United States Coast Survey. Their life was a happy one in all respects. Mrs. Newcomb was able and constant in thoughtfulness for his comfort, health, and happiness, and the remarkably strong individuality of each was thoroughly respected by the other. Mrs. Newcomb is cheered by three surviving daughters, the oldest of whom, Dr. Anita Newcomb McGee, was Acting Assistant Surgeon, United States Army, in charge of the Army Nurse Corps in the Spanish War and until 1901.

Prof. Newcomb became aware several months before his death that his days were numbered, and his remaining energies were devoted to the completion of his investigations of the motion of the moon. He died in Washington on July 11, 1909. His funeral was attended by many who were prominent in science and government, including the President of the United States and representatives of foreign governments. He was buried with military honors in the National Cemetery at Arlington, on the south side of the Potomac River, directly opposite the city of Washington. His chief monument consists of his contributions to astronomical science. An outline of his publications, prepared <sup>10</sup> by Prof. R. C. Archibald, is contained in the following article.

Newcomb's more striking qualities were well described, as below, by the late William Alvord, president of the Astronomical Society of the Pacific, in awarding the Bruce gold medal of the society to him. Alvord was a member of James Lick's first board of trustees, and his acquaintance with Newcomb began in 1874 when the latter was first consulted by the trustees:

The basis of Prof. Newcomb's character is intellectual and moral honesty pushed to the highest degree. He loves truth and detests shams. He has, as it were, a veritable passion for justice—whether in personal relations or in civil matters. The circumstances of his career have made him ruggedly independent in thought and speech. The excellent quality of his mind is that of a philosopher, rather than that of a mathematician or an astronomer merely. \* \* \* In his treatment of all questions it is the philosophical habit of his mind which is the most remarkable and the most valuable. \* \* \* With all these qualities there is a note of practicality in his methods of work which has stood him in good stead and enabled him to complete vast labors which another man scarcely less gifted might not have been able to bring to a termination. \* \* \* It is due to this faculty that the enormous task of revising the elements of the orbits of the major planets and of tabulating them in convenient forms has been carried through to completion in a comparatively short time. \* \* \* This gigantic task would have been above even his power had it not been for this practicality \* \* \*.

Newcomb's work, driven by untiring energy and guided by philosophic intelligence for more than a half century, placed him at the head of his profession in America, and gave him membership in a small class of the most productive astronomers of all countries and all centuries. His influence upon the development of the science was exerted by speech and by letter as well as by published paper and volume. It was potent with beginners and assistants as well as with veterans and directors. It was applied with singleness of purpose, and solely in the interest of the science. Those who discussed astronomy with Newcomb had the impression of obtaining astronomy in the abstract, impersonal and disembodied, and on that account his scientific associates often failed to understand his personality. A survey of Newcomb's activities leads to the view that he was intellectually a giant.

What we may call Newcomb's personal interests made of him a charming friend to many people in many States and countries. He was a lover of travel. Mountain climbing in Switzerland enticed him successfully up to within a year of his death. He read history and other literature extensively. He could recite page after page of poetry. His wide and varied reading, combined with accurate memory and universal interest, made his conversation virile and enlightening. His lamented death brought a sense of severe loss to personal friends as well as to scientific colleagues.

<sup>&</sup>lt;sup>10</sup> Publication of this biographic sketch has been delayed, pending the completion of the bibliography.

## MEMOIRS

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# SIMON NEWCOMB

## 1835-1909

## BIBLIOGRAPHY OF HIS LIFE AND WORK

BY

RAYMOND CLARE ARCHIBALD

1924

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### INTRODUCTORY.

Simon Newcomb was one of the most notable scientists that America has ever produced and no other among her men of research has ever achieved such general recognition of eminence. In 1916 the writer published a paper<sup>1</sup> which was designed to contain a complete record of Newcomb's diplomas, medals, decorations, certificates of membership, and other honors. In the following pages an attempt is made to bring together references to sources of information concerning his life and work.

The references to sources in the case of his life are grouped under the headings: "Majora" (the more important material), "Minora" (material which though of lesser importance seemed worthy of listing), "Portraits-Published Photographs" (reproductions of 16 photographs taken at various times during 50 years), and "Portraits-Paintings" (to be found in public and private places).

As to sources regarding Simon Newcomb's work, it has been the intention to indicate all of his books, pamphlets, memoirs, reports, magazine articles, letters to newspapers or periodicals, reported addresses, etc.—in short, everything in print which he has written or spoken.<sup>2</sup> It has further been the endeavor to make mention of everything published in every edition and every language. For example, in the case of his Popular Astronomy, first published in New York in 1878, there are listed 15 American editions or reprints, 3 English, 7 German, 1 Norwegian, and 1 Russian. Many of the items may appear trivial from some points of view. But in the case of a man so highly honored everything he wrought has interest in indicating his sympathies, his habits of mind and methods of work, and the development of his career.

In order more clearly to indicate different lines of Simon Newcomb's activity, the titles have been rather roughly grouped under the four headings "Astronomy," "Mathematics," "Economics," and "Miscellaneous," but many titles under "Astronomy" might be classed also under "Mathematics" and "Miscellaneous," while some titles under "Mathematics" or "Miscellaneous" might come under "Astronomy" also. There are 541 titles in all.<sup>3</sup>

The most extensive previously published bibliography of Simon Newcomb's work was the one by the writer which appeared in the *Transactions of the Royal Society of Canada* for 1905. Some 370 titles were there listed. In the present work this list has been radically revised and amplified, and more than 160 new titles have been added. While it is known that even the resulting list is not complete, especially in connection with anonymous editorials, reviews, and notes in *The Evening Post, The Nation*, and *Science*, nevertheless it is believed that the approximation to completeness is a good one. Checks have been made with all the English, French, and German bibliographic works, and with the Library of Congress catalog, but there were scores of titles not to be found in any of these sources.

The authorship of a very large number of anonymous notes, reviews, and editorials was determined by consulting the editorial file of *The Nation* and the index volumes of the *Atlantic Monthly* and of the *North American Review*.

At one time it was intended to list all the more important reviews of Simon Newcomb's publications, but this plan was abandoned in favor of listing only those which had been noticed in connection with the main inquiry.

Occasional notes, explanatory of the titles, or containing additional information which would appear to be of interest for one reason or another, have been added to the titles.

As mathematical editor of *Science*, 1895–1903, and as associate editor or editor in chief of the *American Journal of Mathematics* between 1878 and 1909, much of Simon Newcomb's scientific work was unsigned and will never be known.

In the preparation of the material for the following pages it is the writer's duty and privilege to acknowledge the enthusiastic and able cooperation of Simon Newcomb's daughter, Dr. Anita Newcomb McGee.

Brown University, April, 1923.

R. C. A.

<sup>&</sup>lt;sup>1</sup> Science, n. s., vol. 44 (Dec. 22, 1916): 871-878.

<sup>&</sup>lt;sup>2</sup> No attempt has been made to list all articles quoted in such a periodical as The Literary Digest.

<sup>\*</sup> Observation records as In Astronomische Nachrichten, vols. 69, 70, 71, 86, and 90, have not been listed.

### BIBLIOGRAPHY OF SIMON NEWCOMB—ARCHIBALD.

#### ABBREVIATIONS.

Amer. Acad. Proc	. Proceedings of the American Academy of Arts and Sciences, Boston, Mass.
Amer. Assoc. Proc	.Proceedings of the American Association for the Advancement of Science.
Amer. Jl. Math	. American Journal of Mathematics, Baltimore.
Amer. Jl. Sci	. Silliman's American Journal of Science and Arts, New Haven, Conn.
Amer. Math. Mo.	American Mathematical Monthly.
Astr. Jl.	Gould's Astronomical Journal, Cambridge, Mass.
Astr. Nach	Astrononomische Nachrichten, Kiel.
Astr. Papers	Astronomical papers prepared for the use of the American Ephemeris and Nautical Almanac.
Astrophysical J1	Astrophysical Journal, Chicago, Ill.
Bull. Amer. Math. Soc	Bulletin of the American Mathematical Society, New York.
Bull. N. Y. Math. Soc	.Bulletin of the New York Mathematical Society.
Bull. Phil. Soc. Wash	.Bulletin of the Philosophical Society of Washington.
Crelle's Jl.	Journal für die reine und angewandte Mathematik, Berlin.
Comptes Rendus	. Comptes rendus de l'Académie des Sciences de l'Institut de France, Paris.
Educ. Rev	. Educational Review, New York.
<i>Jl</i>	Journal.
Mag	. Magazine.
Math. Mo. (Runkle's)	. Mathematical Monthly, Runkle's, Cambridge, Mass.
Mem. Amer. Acad	. Memoirs of the American Academy of Arts and Sciences.
Mem. Nat. Acad. Sci	. Memoirs of the National Academy of Sciences, Washington.
Мо	. Monthly.
Mo. Notices R. Astr. Soc	. Monthly Notices of the Royal Astronomical Society, London.
N. Amer. Rev	. North American Review, New York.
n. 8	.new series.
Nat. Educ. Assoc. Proc	. Proceedings of the National Education Association.
Phil. Mag	.Philosophical Magazine, London.
Phil. Trans. R. Soc.	. Philosophical Transactions of the Royal Society, London.
Pop. Astr	. Popular Astronomy, Northfield, Minn.
Pop. Sci. Mo.	.Popular Science Monthly.
Pop. Sci. Mo. Suppl	. Popular Science Monthly, Supplement.
Publ. Astr. and Astrophysical Soc. of America.	<sup>c</sup> Publications of the Astronomical and Astrophysical Society of America, Ann Arbor, Mich.
Q. Jl. Econ	.Quarterly Journal of Political Economy.
8	.series.
Sci. Amer. Suppl	.Scientific American Supplement, New York.
Sid. Mess	.Siderial Messenger, Northfield, Minn., and Cincinnati, Ohio.
Smithsonian Contribs. Kn	.Smithsonian Contributions to Knowledge, Washington, D. C.
Smithsonian Misc. Coll	.Smithsonian Miscellaneous Collections, Washington, D. C.
Sirius	.Sirius, Zeitschrift für populäre Astronomie, Leipzig.
Vierteljahrsschrift Astr. Gesell	. Vierteljahrsschrift der Astronomischen Gesellschaft, Leipzig.
Wash. Obs	U. S. Naval Observatory, Washington Observations, Washington, D. C.

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#### SECTION I.

#### LIFE.

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- 66. F. G. CARPENTER. Simon Newcomb, astronomer. Current Literature, vol. 22 (Dec., 1897): 523-524. From the Pittsburg Dispatch.
- 67. E. LEBON. Histoire abrégée de l'astronomie. Paris, Gauthier-Villars, 1899. References to S. Newcomb: pp. 127, 151, 208-211, 218, 220, 224, 258. Portrait facing p. 210.
- 68. W. DRYSDALE. Helps for ambitious boys. New York, T. Y. Crowell Co., 1899. Portrait and note opposite p. 420.
- Anonymous. Simon Newcomb. Geboren 12 Märs 1835 in Wallace (Neuschottland). Mutter Erde, Berlin, vol. 2 (Aug., 1899): 377-378. (Portrait.)
- 70. L. BRENNER. Astronomische Rundschau, Sussinpiccola, Austria, vol. 3 (no. 25, 1901): 160–161. Portrait.
- 71. J. H. BROWN, editor. Lamb's Biographical Dictionary of the United States. Boston, Federal Book Co., vol. 5 (1903). (Woodcut portrait.)
- 72. F. C. BEACH, etc., editors. Encyclopaedia Americana. New York and Chicago, American Book Co., vol. 11 (1904). (Full page portrait.)
- 73. R. JOHNSON and J. H. BROWN, editors. Twentieth Century Biographical Dictionary of Notable Americans. Boston, The Biographical Society, vol. 8 (1904).
- 74. B. J. LOSSING. Harper's Encyclopaedia of United States History. New York, Harpers, vol. 6 (1905): 443. (Portrait.)
- 75. H. MACPHERSON, Jr. A Century's Progress in Astronomy. Edinburgh and London, Blackwood. 1906. Many references to S. Newcomb.
- 76. Anonymous. American star gazers are the best. Washington Herald (Sept. 1, 1907): 5 cols.
- 77. M. McNEILL. Some great American scientists, III. Simon Newcomb. Chautauquan, vol. 48 (Nov., 1907): 394-403. (Portrait.)
- 78. J. B. MORROW. Washington Post (Nov. 1, 1908): 3 cols.
- 79. J. T. FARIS. Winning their way: Boys who learned self-help. New York, Stokes, [1909]. Simon Newcomb: pp. 75-81.
- J. H. HYSLOP. Professor Newcomb and occultism. Jl. Amer. Soc. Psychical Research, vol. 3 (May, 1909): 255-289. Cf. Section V. no. 144.
- S. H. BORGLUM. Some impressions of Simon Newcomb. Independent, vol. 67 (July 22, 1909): 183-5. Not accurate; several misunderstandings.
- 82. Anonymous. The scientific work of the late Prof. Simon Newcomb. Scientific American, vol. 101 (July 24, 1909): 59.
- 83. Anonymous. An American scholar. Outlook, vol. 92 (July 24, 1909): 667–668. Editorial.
- 84. W. T. LYNN. Professor Newcomb. Jl. Brit. Astr. Assoc., London, vol. 19 (July 30, 1909): 402-403.
- 85. A. E. BOSTWICK. Simon Newcomb: America's foremost astronomer. Amer. Review of Reviews, vol. 40 (Aug., 1909): 170-174. (Portrait.)
- 86. Anonymous. The death of Simon Newcomb. Pop. Sci. Mo., vol. 74 (Aug., 1909): 204-206. (Portrait.)
- 87. Anonymous. About Simon Newcomb and the fun he had. *Life*, vol. 54 (Aug. 5, 1909): 174–175. Good character sketch; evidently written by one who knew him well.

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88.	Anonymous. Professor Newcomb and Father Höll. America, New York, vol. 1 (Aug. 7, 1909): 465. Editorial.
89.	Anonymous. Economic II London vol 19 (Sept. 1909): 493
90.	Anonymous. The greatest astronomer of our time. Current Literature, vol. 47 (Sept., 1909): 326–328. (Portrait.) Quotes from Scientific American, Cosmos, Knowledge and Nature.
91.	B. BAILLAUD. Simon Newcomb. Revue générale des sciences, Paris, vol. 20 (Sept. 15, 1909): 725-727.
92.	Anonymous. Simon Newcomb. L'Enseignement Mathématique, Geneva, vol. 11 (Oct., 1909): 403-404.
93.	T. T. $\odot$ [Simon Newcomb; in annual report of the Council, April, 1910.]
94.	D. S. JORDAN The permanent wealth of the nation.
	Independent, vol. 68 (June 16, 1910): 1329–1332. Commencement address, using the life of Simon Newcomb as part of his text.
95.	Mrs. S. N. MERRICK. John and Simon Newcomb, the story of a father and son. McClure's Mag., vol. 35 (Oct., 1910): 677-687. (Six portraits of S. Newcomb at different periods of life.) More accurate presentation of these facts is found in the Reminiscences (see no. 14 of this Section). The author was S. New- comb's sister.
96.	<b>R. RATHBUN.</b> Notes on the bequest to the National Museum.
97.	G. H. HAMILTON. Simon Newcomb, in J. J. Conway's Footprints of Famous Americans in Paris
	London: John Lane, 1912, pp. 220–223.
98.	A. N. McGEE. Simon Newcomb on flying.
	New York Times (Apr. 20, 1919), section 3, p. 2, col. 8.
1050	PORTRAITS-PUBLISHED PHOTOGRAPHS.
1858.	Aged 23: Reproduced in <i>McClure's Mag.</i> , vol. 35 (Oct., 1910): 680.
1862.	Arred 97:
	Reproduced in <i>McClure's Mag.</i> , vol. 35 (Oct., 1910): 680.
1863,	<ul> <li>Ageu 27.</li> <li>Reproduced in <i>McClure's Mag.</i>, vol. 35 (Oct., 1910): 680.</li> <li>This entry, and others that follow, correct statements made in this article.</li> <li>fall. Aged 28: Photograph with Mrs. Newcomb, shortly after their marriage.</li> <li>Reproduced in <i>McClure's Mag.</i>, vol. 35 (Oct., 1910): 685.</li> </ul>
1863, 1871 <i>.</i>	<ul> <li>Aged 27.</li> <li>Reproduced in <i>McClure's Mag.</i>, vol. 35 (Oct., 1910): 680. This entry, and others that follow, correct statements made in this article.</li> <li>fall. Aged 28: Photograph with Mrs. Newcomb, shortly after their marriage. Reproduced in <i>McClure's Mag.</i>, vol. 35 (Oct., 1910): 685.</li> <li>Aged 34: Reproduced in <i>McClure's Mag.</i>, vol. 35 (Oct., 1910): 681.</li> </ul>
1863, 1871 <i>.</i> 1879,	<ul> <li>Aged 27.</li> <li>Reproduced in <i>McClure's Mag.</i>, vol. 35 (Oct., 1910): 680. This entry, and others that follow, correct statements made in this article.</li> <li>fall. Aged 28: Photograph with Mrs. Newcomb, shortly after their marriage. Reproduced in <i>McClure's Mag.</i>, vol. 35 (Oct., 1910): 685.</li> <li>Aged 34: Reproduced in <i>McClure's Mag.</i>, vol. 35 (Oct., 1910): 681.</li> <li>Dec. Aged 44: Reproduced in <i>McClure's Mag.</i>, vol. 35 (Oct., 1910): 681.</li> </ul>
1863, 1871. 1879, 1879,	<ul> <li>Aged 27.</li> <li>Reproduced in McClure's Mag., vol. 35 (Oct., 1910): 680. This entry, and others that follow, correct statements made in this article.</li> <li>fall. Aged 28: Photograph with Mrs. Newcomb, shortly after their marriage. Reproduced in McClure's Mag., vol. 35 (Oct., 1910): 685.</li> <li>Aged 34: Reproduced in McClure's Mag., vol. 35 (Oct., 1910): 681.</li> <li>Dec. Aged 44: Reproduced in McClure's Mag., vol. 35 (Oct., 1910): 681.</li> <li>Dec., 16. Aged 44: Photograph by Wm. Klauser, New York. Reproduced in Eclectic Mag., vol. 94 (April, 1880): opposite page 385. (Steel engraving by J. J. Cade of New York.)</li> </ul>
1863, 1871. 1879, 1879,	<ul> <li>Aged 27.</li> <li>Reproduced in McClure's Mag., vol. 35 (Oct., 1910): 680. This entry, and others that follow, correct statements made in this article.</li> <li>fall. Aged 28: Photograph with Mrs. Newcomb, shortly after their marriage. Reproduced in McClure's Mag., vol. 35 (Oct., 1910): 685.</li> <li>Aged 34: Reproduced in McClure's Mag., vol. 35 (Oct., 1910): 681.</li> <li>Dec. Aged 44: Reproduced in McClure's Mag., vol. 35 (Oct., 1910): 681.</li> <li>Dec., 16. Aged 44: Photograph by Wm. Klauser, New York. Reproduced in Eclectic Mag., vol. 94 (April, 1880): opposite page 385. (Steel engraving by J. J. Cade of New York.) Also in Harper's Mag., vol. 62 (March, 1881): 550. (Woodcut.) Also in nos. 55 and 56 above.</li> </ul>
1863, 1871. 1879, 1879, 1884,	<ul> <li>Ageu 27.</li> <li>Reproduced in McClure's Mag., vol. 35 (Oct., 1910): 680. This entry, and others that follow, correct statements made in this article.</li> <li>fall. Aged 28: Photograph with Mrs. Newcomb, shortly after their marriage. Reproduced in McClure's Mag., vol. 35 (Oct., 1910): 685.</li> <li>Aged 34: Reproduced in McClure's Mag., vol. 35 (Oct., 1910): 681.</li> <li>Dec. Aged 44: Reproduced in McClure's Mag., vol. 35 (Oct., 1910): 681.</li> <li>Dec., 16. Aged 44: Photograph by Wm. Klauser, New York. Reproduced in Eclectic Mag., vol. 94 (April, 1880): opposite page 385. (Steel engraving by J. J. Cade of New York.) Also in Harper's Mag., vol. 62 (March, 1881): 550. (Woodcut.) Also in nos. 55 and 56 above.</li> <li>Aug. Aged 49: Photograph by W. C. Taylor, Philadelphia, Pa. Reproduced in Harper's Weckly, vol. 28 (Sept. 27, 1884): 630. Also in no. 74 above.</li> </ul>
1863, 1871. 1879, 1879, 1884, 1884,	<ul> <li>Aged 21.</li> <li>Reproduced in McClure's Mag., vol. 35 (Oct., 1910): 680. This entry, and others that follow, correct statements made in this article.</li> <li>fall. Aged 28: Photograph with Mrs. Newcomb, shortly after their marriage. Reproduced in McClure's Mag., vol. 35 (Oct., 1910): 685.</li> <li>Aged 34: Reproduced in McClure's Mag., vol. 35 (Oct., 1910): 681.</li> <li>Dec. Aged 44: Reproduced in McClure's Mag., vol. 35 (Oct., 1910): 681.</li> <li>Dec., 16. Aged 44: Photograph by Wm. Klauser, New York. Reproduced in Eclectic Mag., vol. 94 (April, 1880): opposite page 385. (Steel engraving by J. J. Cade of New York.) Also in Harper's Mag., vol. 62 (March, 1881): 550. (Woodcut.) Also in nos. 55 and 56 above.</li> <li>Aug. Aged 49: Photograph by W. C. Taylor, Philadelphia, Pa. Reproduced in Harper's Weekly, vol. 28 (Sept. 27, 1884): 630. Also in no. 74 above.</li> <li>spring. Aged 52: Photograph by Bachrach, Baltimore. Reproduced in Harper's Weekly, vol. 38 (Dec. 1, 1894): 1144. Also in Amer. Math. Mo., vol. 1 (Aug., 1894): frontispiece. Also in Amer. Math. Mo., vol. 1 (Aug., 1894): frontispiece.</li> </ul>
1863, 1871. 1879, 1879, 1884, 1884,	<ul> <li>Reproduced in McClure's Mag., vol. 35 (Oct., 1910): 680. This entry, and others that follow, correct statements made in this article.</li> <li>fall. Aged 28: Photograph with Mrs. Newcomb, shortly after their marriage. Reproduced in McClure's Mag., vol. 35 (Oct., 1910): 685.</li> <li>Aged 34: Reproduced in McClure's Mag., vol. 35 (Oct., 1910): 681.</li> <li>Dec. Aged 44: Reproduced in McClure's Mag., vol. 35 (Oct., 1910): 681.</li> <li>Dec., 16. Aged 44: Photograph by Wm. Klauser, New York. Reproduced in Eclectic Mag., vol. 94 (April, 1880): opposite page 385. (Steel engraving by J. J. Cade of New York.) Also in Harper's Mag., vol. 62 (March, 1881): 550. (Woodcut.) Also in nos. 55 and 56 above.</li> <li>Aug. Aged 49: Photograph by W. C. Taylor, Philadelphia, Pa. Reproduced in Harper's Weckly, vol. 28 (Sept. 27, 1884): 630. Also in no. 74 above.</li> <li>spring. Aged 52: Photograph by Bachrach, Baltimore. Reproduced in Harper's Weckly, vol. 38 (Dec. 1, 1894): 1144. Also in Amer. Math. Mo., vol. 1 (Aug., 1894): frontispiece. Also in nos. 3, 7, and 62 above.</li> </ul>

on American economists of the day). Also in *Harper's Weekly*, vol. 53 (July 17, 1909), p. 6 of the issue. Also in no. 29 above.

- 1896. Aged 61: Photograph by Bachrach, Baltimore. Reproduced in Amer. Review of Reviews, vol. 25 (Apr., 1902): 430; also vol. 30 (Sept., 1904): 323; also vol. 40 (Aug., 1909): 170. Also in no. 45.
- 1897, Aug. or Sept. Aged 62: Photograph by A. D. Wyatt, Brattleboro, Vt. Reproduced in Harper's Weekly, vol. 43 (Nov. 25, 1899): 1184.
  Also in Publs. Astron. and Astrophysical Society of America, vol. 1 (1910): frontispiece. Also in nos. 11, 12, 26, 30, 31, 38, 42, 69, and 77 above; also no. 216 (ed. by G. Iles) of Section II.
- 1903. Aged 68: Bachrach, Baltimore and Washington, D. C. In nos. 14, 72, and 86 above.
- 1907, May 4. Aged 72: Photograph taken by F. S. Archenhold in Washington, D. C. Reproduced in Weltall, Berlin, vol. 10 (Aug. 15, 1910): opposite page 322; no. 44 above.
- 1907, Aug. 7. Aged 72: Photograph taken by Mr. C. A. Chant, of Toronto, at the Lick Observatory.

Reproduced with, "Note regarding the portrait of Professor Newcomb" in Jl. Roy. Astr. Soc. Can., vol. 3 (July-Aug., 1909): 312-313.

- 1909, Mar. Aged 74: Photograph by Harris and Ewing, Washington, D. C. Reproduced in *Outlook*, vol. 92 (July 24, 1909): 757.
- 1909, Mar. Aged 74: Another photograph (taken same day) by Harris and Ewing, Washington, D. C.

Reproduced in Sci. Amer., vol. 101 (July 24, 1909): 53. Also in no. 90 above.

The portraits in nos. 67 and 71 above have not been identified.

#### PORTRAITS-PAINTINGS.

- 1. By E. F. Miller, of Washington, D. C., 1882. Property of S. Newcomb's daughter, Mrs. Josepha Whitney, 227 Church Street, New Haven, Conn.
- 2. By Julius Ulke, of Washington, 1887.
  - Portrait ordered by the Russian Government for the gallery of famous astronomers at the Imperial Observatory of Poulkovo. Simon Newcomb is the only representative of America in the gallery.
- By R. G. Hardie, of Boston, 1897.
   Portrait ordered by colleagues and friends and presented to Johns Hopkins University. Reproduced in New England Mag., n. s. vol. 19 (Sept., 1898): 10. Reproduced (from a photo of the painting, by A. D. Wyatt, of Brattleboro, Vt.) in the Amer. Jl. Math., vol. 21 (Jan., 1899): frontispiece.
- 4. By C. H. L. Macdonald, of Washington, D. C., painted about 1899. Property of Mrs. Josepha Whitney.
- By C. H. L. Macdonald, of Washington, D. C., copied from no. 4 in the fall of 1909, with reference also to the Wyatt photograph of 1897.
   Portrait ordered by friends and presented to the American Philosophical Society for their rooms in Philadelphia, Pa.
- 6. By C. H. L. Macdonald, of Washington, D. C., copy of no. 5. In the National Museum, Washington. Loaned by Dr. Anita N. McGee.
- 7. By C. H. L. Macdonald, of Washington, D. C., another copy of no. 5. Property of S. Newcomb's daughter, Mrs. F. A. Wilson, Pelham, N. Y.
- 8. By C. H. L. Macdonald, of Washington, another copy of no. 5 on a smaller scale. Property of S. Newcomb's granddaughter, Mrs. David M. Willis, Fairfax, Marin Co., Calif.
- 9. By H. F. Waltman, of New York City, painted about 1906.

Property of the Cosmos Club, Washington, D. C. The picture is 17 x 14 inches in size.

There is also a crayon portrait made in 1880 or 1881 by Dr. Anita N. McGee from Klauser's photograph of 1879. It is now in her possession in Washington.

Finally there is a medallion of Simon Newcomb in the science panel of one of two bronze doors for the west entrance of the United States Capitol. These doors were designed and modeled by Professor Louis Amateis in 1910. At present they are in the vestibule of the New National Museum.

### SECTION II.

### ASTRONOMY.

1. Velocity of meteors. Motion of bodies impelled by a single center of force.

The National Intelligencer, Washington (May 26, 1855), col. 2.

- A letter dated Suddersville, Md., May 19, 1855, in reply to a letter of May 5, by G. W. Eveleth. "When in Maryland I read an elaborate attempt to refute the Copernican system of astronomy, and was quite surprised after waiting some days or weeks to find that no one ventured to point out the writer's fallacies. Fearing that sound knowledge was in danger, I at length ventured in a reply which in due time appeared over my name in The Intelligencer . . . It provoked two pleasing attentions-a book from Col. J. J. Abert, of the topographical engineers, and a letter and a pamphlet from Prof. J. Lawrence Smith." Quotation from no. 169 of this bibliography, below.
- 2. Elements and ephemeris of the fifty-fourth asteroid, by S. Newcomb and T. H. Safford. Astr. Jl., vol. 5 (Oct. 16, 1858): 162.
- 3. Elliptic elements of comet, 1858, V. Astr. Jl., vol. 5 (Dec. 20, 1858): 178.
- 4. On the secular variations of the eccentricities and perihelia of the asteroids Vesta, Metis, Hygea, and Parthenope.

Astr. Jl., vol. 6 (Nov. 25, 1859): 65-67.

5. Comparison of the lunar ephemeris in the American Ephemeris and Nautical Almanac, with Greenwich Observations.

Astr. Jl., vol. 6 (Nov. 25 and Dec. 7, 1859): 67-69; 175-176. First communication dated Oct. 13, 1859.

- 6. Note on an inequality of long period between the planets Mars and Juno. Astr. Jl., vol. 6 (Dec. 21, 1859): 80.
- 7. On the secular variations of the eccentricities and perihelia of certain of the asteroids. Amer. Assoc. Proc., Cambridge, 1859, vol. 13 (1860): 158-162.
- 8. On the secular variations and mutual relations of the orbits of the asteroids. Mem. Amer. Acad., n. s., vol. 5 (1860): 123-152.
- 9. A review of *Popular Astronomy* by O. M. Mitchell. Atlantic Monthly, New York, vol. 6 (July, 1860): 117-119. Anonymous.
- 10. On the supposed intra-mercurial planets.

Astr. Jl., vol. 6 (Nov. 13, 1860): 162-163.

- 11. On some illusions and other phenomena attendant on vision through colored media. Amer. Jl. Sci., vol. 21 (May, 1861): 418-419.
- 12. Modern theoretical astronomy.

N. Amer. Rev., vol. 93 (Oct., 1861): 367-390. Anonymous.

13. Smith's Illustrated Astronomy, designed for the use of the public or common schools in the United States ... by Asa Smith ... Revised and improved from Notes and Manuscripts of New Discoveries which have been made to the present date (1860), furnished by Prof. Newcomb, of the astronomical department at Cambridge, Mass.

Boston, Chase and Nichols, 1862, Sm. 4to. 79 pp.

- 14. On Dr. Lehmann's new determination of the Gaussian constant K. Astr. Nach., vol. 57 (Feb. 22, 1862): cols. 65-68. Remarks on this by Lehmann, vol. 60, col. 289.
- 15. Determination of the law of distribution of the nodes and perihelia of the small planets between Mars and Jupiter.

Astr. Nach., vol. 58 (Sept. 25, 1862): cols. 209-220.

The preface to this revised edition states that it had run through fifteen editions since its publication. There were Spanish and Portuguese editions of this work; the American Catalogue of Books in Print and for sale July 1, 1876, lists them as offered for sale by D. Appleton & Co. Whether or not these are translations of the 1860 (or later) edition could not be determined. In the Library of Congress the latest Spanish edition is Astronomia illustrada de Smith ... published in New York by Daniel Burgess & Co., in 1853. In the library of the British Museum there is not only a Spanish edition of 1857 but also a French edition published at Strasbourg in 1854.

Another edition, Boston, S. F. Nichols, 1866, 4to, 79 pp.

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#### ASTRONOMY.

16. Longitude of Washington as derived from moon calculations observed at the Royal Observatory, Greenwich, and the United States Observatory, Washington, during the years, 1846–1860, inclusive.

Wash. Obs., Appendix A (1362): xliii-li.

- On Kowalski's theory of Neptune. Mo. Notices R. Astr. Soc., vol. 25 (1865): 45-47.
- Investigation of the latitude and longitude of the United States Naval Observatory, Washington, and of the declinations of certain circumpolar stars. Wash. Obs., 1864 (1866), pp. xxxix-xlvii.
- 18A. On the latitude and longitude of the United States Naval Observatory, Wushington, and the declinations of certain circumpolar stars. [Washington, 1866?], 9 pp., and cover title. [Appendix to the introduction to Wash. Obs., 1864].
- An investigation of the orbit of Neptune, with general tables of its motion. Washington, Smithsonian Institution, January, 1866, 6+111 pp. Also in Smithsonian Contribs. Kn.. vol. 15, art. 2 Smithsonian Institution publication no. 199.
- 20. Measures of the Companion of Sirius made at the United States Naval Observatory, Washington, 1866, with a note on the identity with the disturbing body indicated by theory.

Astr. Nach., vol. 66 (May 4, 1866): cols. 381–384. A small part of the communication is by C. H. Davis.

- Schreiben des Herrn Prof. Simon Newcomb an den Herausgeber.
   Astr. Nach., vol. 67 (Sept. 6, 1866): cols. 347-348.
   Letter, dated Washington, July 24, 1866, correcting a statement of Dr. Oppolzer's in regard to Leverrier's Solar Tables.
- Observations of the later asteroids made at the United States Naval Observatory, Washington, with the great transit circle of Pistor & Martins. Astr. Nach., vol. 67 (Sept. 12, 1866): cols. 363-367.
- 23. Description of the transit circle of the United States Naval Observatory. Wash. Obs., 1865, app. 1 (1867): 47 pp.+8 pls.
- 23A. Description of the transit circle of the United States Naval Observatory, with an investigation of its constants.

Washington, Govt. print. off., 1867. 3+50 pp., 8 folding pls.

- 24. An investigation of the distance of the sun and of the elements which depend upon it. Washington Obs., 1865, app. 2 (1867): 29 pp.
- 24A. An investigation of the distance of the sun and of the elements which depend upon it, from the observations of Mars made during the opposition of 1862, and from other sources.

Washington, Govt. print. off., 1867. 29 pp.

- 25. The United States Naval Observatory. N. Amer. Rev., vol. 105 (Oct., 1867): 382-393. Anonymous.
- 26. Sur la parallaxe du soleil.

Comptes Rendus, vol. 65 (Nov. 25, 1867).

Letter dated United States Observatory, Washington, Oct. 31, 1867, to M. Delaunay.

27. Observations and discussions on the meteoric showers of November, 1867, U. S. Naval Observatory, Washington. [Reports by S. Newcomb, W. Harkness, and J. R. E. Eastman.]

Washington, Govt. print. off., 1867, 40 pp., 3 maps.

S. Newcomb's report, pp. 5-12; map A by S. Newcomb and W. Harkness.

28. Meteoric showers.

N. Amer. Rev., vol. 107 (July, 1868): 38-50.

This is in the form of a combined review of (1) Observations and Discussions on the meteoric showers of November Meteors of 1867 by the United States Naval Observatory [no. 27]; (2) Meteoric Astronomy by D. Kirkwood; and (3) A Treatise on Meteorology by E. Loomis.

#### 34 BIBLIOGRAPHY OF SIMON NEWCMOB-ARCHIBALD. [Memoirs National [Vol. XVII,

- 29. On Hansen's theory of the physical constitution of the moon. *Amer. Assoc. Proc.*, vol. 17 (1868): 167-171.
   Also (abridged) in *Amer. Jl. Sci.*, 2s. vol. 46 (Nov., 1868): 376-378.
   Also (abridged) in *Phil. Mag.*, 4 s. vol. 37 (Jan., 1869): 32-35.
- 30. Comparison de la théorie de la lune de M. Delaunay avec celle de M. Hansen. Comptes Rendus, vol. 46 (June 15, 1868): 1197-1200.
- Remarks on Mr. Stone's rediscussion of the transit of Venus, 1769 [a criticism of Mr. Stone's interpretation of Chappe's observations of egress in 1769]. Mo. Notices R. Astr. Soc., vol. 29 (1868): 6-7.
- 32. Comparison of the actual and probable distribution in longitude of the nodes and perihelion of 105 small planets. *Astr. Nach.*, vol. 73 (Mar. 15, 1869): cols. 278-288.
- 33. On the observing of corona, etc., during a total eclipse. Amer. Jl. Sci., 2 s., vol. 47 (May, 1869): 413-415.
- Note on the theory of aberration. Astr. Nach., vol. 74 (Aug. 2, 1869): cols. 237-240.
- 35. Report on observations of the total eclipse of the sun, Aug. 7, 1869. Conducted under the direction of Commodore B. F. Sands.
  Washington, Govt. print. off. (1869): 214 pp.
  Also in Wash. Obs., 1867, app. 2 (1870).
  Reports from ten scientists; S. Newcomb's report, pp. 5-22.
- 36. Positions of fundamental stars deduced from observations made at the U. S. Naval Observatory between the years 1862 and 1867.
   Wash. Obs., 1867 app. 3 (1870) 46 pp.
   Also Washington, Govt. print. off., 1870, 46 pp.
- 37. Aperçu d'une méthode directe et facile pour effectuer le developpement de la fonction perturbative et de ses coefficients differentiels. Comptes Rendus, vol. 70 (Feb. 21, 1870): 385-388.
- 38. On the mode of observing the coming transits of Venus. Amer. Jl. Sci., vol. 50 (July, 1870): 74-83. Beed before the National Academy of Sciences April 13, 1870. The substance of the paper was also by

Read before the National Academy of Sciences, April 13, 1870. The substance of the paper was also published in Nature, Lon don, vol. 2 (Aug. 25, 1870): 343-345.

- 39. Sur les inégalités de la lune dues à l'action des planètes. Comptes Rendus, vol. 71 (Aug. 22, 1870): 384-386.
- 40. Sur la manière d'observer le prochain passage de Venus, par M. S. Newcomb: note de M. Faye.

Comptes Rendus, vol. 71 (Sept. 12, 1870): 413.

- 41. Considerations on the apparent inequalities of long period in the mean motion of the moon. *Amer. Jl. Sci.*, 2 s. vol. 50 (Sept., 1870): 183-194. Read before the National Academy, April 13, 1870.
- 42. On a very accurate method of determining the relative positions of the centers of the sun and moon during a nearly central eclipse of the sun. Astr. Nach., vol. 76 (Oct. 27, 1870): cols. 365-368.
- 43. Théorie des perturbations de la lune qui sont dues à l'action des planètes. Comptes Rendus, vol. 72 (Apr. 3, 1871): 403-406.
- 44. Review of P. A. Secchi's Le Soleil ... and R. A. Proctor's The Sun ... Nature, London, vol. 4 (May 18, 1871): 41-43.
- 45. Review of P. A. Secchi's Le Soleil ...
  - Nature, London, vol. 4 (June 29, 1871): 160. Reply by Newcomb to a complaint of R. Proctor in a letter, dated May 18, on the review. Proctor replies to this letter, making interesting statements about Newcomb, Nature, London, vol. 4 (July 6, 1871): 183.
- 46. Phenomena of contact.
  - Nature, London, vol. 4 (Sept. 28, 1871): 423.
- 47. The solar parallax.

Nature, London, vol. 4 (Nov. 23, 1871): 160. Letter dated Oct. 23, 1871. ACADEMY OF SCIENCES.] No. 1.]

#### ASTRONOMY.

- 48. Reports on observations of the total solar eclipse of December 22, 1870 [at Gibraltar]. Washington, Govt. print. off., 1871, 132 pp. Also in Wash. Obs., 1869, app. 1 (1872).
  S. Newcomb's report, pp. 5-24, is one of five.
- 49. Memoir ... on the lunar theory. *Mo. Notices R. Astr. Soc.* vol. 31 (suppl. no., 1871): 265-268.
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- 172. Perturbations of the four inner planets. Bull. N. Y. Math. Soc., vol. 1 (Feb., 1892): 120–122. Review by "S. N." of Astr. Papers, vol. 3, last part.
- 173. Our national observatory. The Evening Post, New York (Feb. 13, 1892).
- 174. On the dynamics of the earth's rotation, with respect to the periodic variations of latitude. Mo. Notices R. Astr. Soc., vol. 52 (Mar. 11, 1892): 336-341.
- 175. Results of the observations of a Lyrae, made during the years 1862-67, with the primevertical transit of the U. S. Naval Observatory. Astr. Jl., vol. 11 (Apr. 28, 1892): 182-183.
- 176. On the law and the period of the variation of terrestrial latitudes. Astr. Nach., vol. 130 (June 18, 1892): cols. 1-6. Dated, Aix-les-Bains, Savoie, June 1, 1892.
- 177. Remarks on Mr. Chandler's law of variation of terrestrial latitudes. Astr. Jl., vol. 12 (July 22, 1892): 49-50.

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178. Observations of the solar eclipse of 1892, October 20, made at the Johns Hopkins University, Baltimore.

Astr. Jl., vol. 12 (Dec. 9, 1892): 141; vol. 13 (Mar. 9, 1893): 24.

179. "Algebra," "Algol," "Almanac," "Almucantar," "Altazimuth," "Analysis," "Angle," "Asteroids," "Astronomy," "Binary system," "Calculus," "Collimation," "Collimator," "Comets," "Composition of forces," "Curves," "Eclipse," "Ecliptic," "Energy," "Energy, conservation of," "Equation," "Falling bodies," "Fluxions," "Functions," "Geodesy," "Geometry," "Horizon," "Imaginary quantities," "Incommensurables," "Infinities and infinitesimals," "Interpolation," "Jupiter," "Light," "Limits," "Logarithms," "Magic squares," "Mars," "Mathematics," "Mercury," "Moon," "Nebular hypothesis," "Observatory," "Occultations," "Orbit," "Parallax," "Perturbations," "Photometry," "Planet," "Precession of the equinoxes," "Probability," "Trogression," "Ptolemaic system," "Quadrature of the circle," "Quaternions," "Saturn," "Series," "Solar parallax," "Solar system," "Stars," "Sun," "Telescope," "Time," "Transit," "Transits of Venus and Mercury," "Year," "Year," "Zodiacal light," in Johnson's Universal Cyclopedia [later Universal Cyclopedia and Atlas], 8 volumes.

New York, A. A. Johnson Co., 1893–1895.
S. Newcomb was the "Associate editor" for "astronomy and mathematics" in connection with this work. See also nos. 102 and 258 in this Section.

180. On the lunar equation in the heliocentric motion of the earth.

Astr. Nach., vol. 132 (Mar. 8, 1893): cols. 161–164. Dated Washington, Jan. 1, 1893.

180X<sup>1</sup>. [Letter dated June 21, 1893, to the Secretary of the Navy, and a testimonial to Dr. J. Morrison dated May 1, 1886].

Astronomy and Astrophysics, Northfield, Minn., vol. 12 (Aug. and Oct., 1893): 665, 760. Compare no 61 of Section I.

181. A development of the perturbative function in cosines and multiples of the mean anomalies and of angles between the perihelia and common node and in powers of the eccentricities and mutual inclinations.

Astr. Papers, vol. 5, 1895, pt. 1 (1894): 1-48.

182. Inequalities of long period stars and of the second order as to the masses in the mean longitudes of the four inner planets.

Astr. Papers, vol. 5, 1895, pt. 2 (1894): 49-96.

- 183. Theory of the inequalities in the motion of the moon produced by the action of the planets. Astr. Papers, vol. 5, 1895, pt. 3 (1894): 97-295.
- 184. Secular variations of the orbits of the four inner planets. Astr. Papers, 1895, vol. 5, pt. 4 (1894): 297-378.
- 185. Considerations on the best methods of determining the positions of the planets by observation.

Astr. Jl., vol. 13 (Feb. 10, 1894): 191-192.

- 186. Remarks on Mr. Stone's proposed corrections to the measure of time since 1864. Mo. Notices R. Astr. Soc., vol. 54 (Mar. 9, 1894): 286-288.
- 187. Two questions on Mr. Stone's proposed correction in the measure of time. Mo. Notices R. Astr. Soc., vol. 54 (May 11, 1894): 408. "Reply to Professor Newcomb's two questions" by Mr. Stone, pp. 409-412.
- 188. On the elements of (33) Polyhymnia and the mass of Jupiter.

Astr. Nach., vol. 136 (Aug. 29, 1894): cols. 129-134.

Dated Washington, June 1, 1894. Compare no. 205, below.

189. Reorganization of the Naval Observatory.

The Evening Post, New York, vol. 93. (Sept. 26, 1894): 6, cols. 4-5.

- Also in Nation, New York, vol. 29 (Sept. 27, 1894): 228.
  - Anonymous editorial.

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- Note on Mr. Stone's theory of the measure of time. Mo. Notices R. Astr. Soc., vol. 55 (Nov. 9, 1894): 3.
- 192. The world's debt to astronomy. Chautauquan, vol. 20 (Dec., 1894): 286–291. Also in Side-lights on Astronomy (1906): 216–226; see no. 300 in this Section.
- 193. Sur les variations séculaire des orbites des quatre planètes intérieures. Comptes Rendus, vol. 119 (Dec. 10, 1894): 983-986.
- 194. A very popular astronomer. Nation, New York, vol. 59 (Dec. 20, 1894): 469. Anonymous review of Flammarion's Popular Astronomy translated into English by J.E. Gore.
- 195. On the mass of Jupiter and the orbit of Polyhymnia. Astr. Papers, vol. 5, 1895, pt. 5 (1895): 379-449.
- 196. Tables of the motion of the earth on its axis around the sun. Astr. Papers, vol. 6, 1898, pt. 1 (1895): 7-169.
- 197. Tables of the heliocentric motion of Mercury. Astr. Papers, vol. 6, 1898, pt. 2 (1895): 171-270.
- 198. Tables of the heliocentric motion of Venus. Astr. Papers, vol. 6, 1898, pt. 3 (1895): 271-382.
- 199. Tables of Jupiter, by G. W. Hill, with prefatory note by Simon Newcomb Astr. Papers, vol. 7, pt. 1 (1895):
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  - Preface dated Jan. 7, 1895.
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- 201. On the principal fundamental constants of astronomy. Astr. Jl., vol. 14 (Jan. 31, 1895): 185–189.
- 202. Note on the solar parallax as derived from the observed parallactic inequality of the moon. Astr. Jl., vol. 15 (Oct. 16, 1895): 167-168.
- 203. On the value of the precessional constant. Astr. Jl., vol. 15 (Nov. 23, 1895): 185-188.
- 204. Conférence internationale des étoiles fondamentales de 1896. Procès-verbaux.

Paris [Bureau des Longitudes], 1896. 90 pp.

In this report of the discussion and conclusions of this important conference, held in Paris, May 18-21, and in which Bauschinger, Newcomb, Backlund, Downing, Gill, Loewy, Tisserand, and Faye participated, S. N. took the most prominent part, and his remarks appear on practically every page of the discussion.

- 205. Elements of (33) Polyhymnia. Astr. Nach., vol. 139 (Jan. 21, 1896): cols. 271–272. Dated Washington, Jan., 1896. Compare no. 188, above.
- 206. On Boss's system of declinations and on that of the Astronomische Gesellschaft. Astr. Jl., vol. 16 (Feb. 3, 1896): 33-36.
- 207. American judgment of American astronomy. Science, New York, n. s., vol. 3 (Feb. 21, 1896): 284-286.
- 208. On the variation of personal equation with the magnitude of the star observed. Astr. Jl., vol. 16 (Mar. 21, 1896): 65-67.
- 209. The influence of atmospheric and oceanic currents upon terrestrial latitudes. Astr. Jl., vol. 16 (Apr. 6, 1896): 81-82. Also in Nature, London, vol. 53 (Apr. 30, 1896): 618-619. Also in Sci. Amer. Suppl., vol. 42 (July 4, 1896): 17098-17099.
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Astr. Jl., vol. 17 (Dec. 10, 1896): 41-44.

Last sentence: "I hope soon, in a second paper, to treat the subject more fully by a modified method." This "second paper" does not seem to have been published, although the subject was treated elsewhere (e. g. nos. 216, 217, 221).

- 212. "Astronomy," "Photography, Astronomical," "Telescope," in New American Supplement to the Encyclopædia Britannica edited . . . [by] D. O. Kellog, 5 vols. New York and Chicago, The Werner Co., 1897.
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- 214. Note on the foregoing article [this is, Nyrén's determination of constant aberration at Pulkova.]

Astr. Jl., vol. 17 (Feb. 19, 1897): 90.

- 215. An ambitious paradoxer.
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- 216. The problems of astronomy. An address at the dedication of the Flower Observatory at the University of Pennsylvania, May 12, 1897.

Lancaster, Pa., The New Era Printing Co., 1897, 20 pp.

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- An extract of this, entitled "The extent of the Universe," appeared in *Current Lit.*, vol. 22 (Dec., 1897): 560. An extract, entitled "Professor Newcomb on the distances of the stars," appeared in *Nature*, London, vol. 56 (June 10, 1897): 139-140. Also in *Smithsonian Report*, 1896 (1898): 83-92.
- Also in Side-Lights on Astronomy, under the title "The evolution of astronomical knowledge" (1906): 258-273; see no. 300 in this Section.
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- 217. Solar motion and stellar distances.
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218. A new determination of the precessional motion.

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- 219. Reasons for the adoption of new values of the precessional motions; a reply to the remarks of Boss in A. J. 410.

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- 233. Statement of the theoretical laws of the polar motion.
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- 234. Tables of the heliocentric motion of Uranus.

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ACADEMY OF SCIENCES.] No. 1.1

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- In the Science for Everybody Series.
- In the fall of 1910, 5,000 copies of this work had been sold in America alone. In 1918-19, 500 copies of this work were sold to the American Library Association for the use of the U.S. Army overseas. It is the "best seller" of all books listed in this Section. Doubleday Page is now the publisher.
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  - Reviewed Nature, London, vol. 69 (Nov. 26, 1903): 75-76. Reviewed The Observatory, London, vol. 26 (Oct., 1903): 394-396.
- 277A. Russian translation-Astronomifa dlfa vsfekh Per. s Angl., s predisl. A. Orbinskago (Astronomy for Everybody-Translation from the English, with an introduction, by A. Orbinskij.)
  - Odessa, "Technik," 1905. 14+285 pp.

Second edition, 1911. 20+288 pp.

277B. German translation—Simon Newcomb's Astronomie für Jedermann—Eine allgemeinverständliche Darstellung der Erscheinungen des Himmels. Nach der Übersetzung von F. Gläser, bearbeitet von R. Schorr und K. Graff.

Jena, Verlag von Gustav Fischer, 1907, 8+364 pp.

Zweite Auflage, Jena, 1910, 10+366 pp.+6 maps. Dritte Auflage, 1920, 12+385 pp. Vierte Auflage, 1921, 8+409 pp., mit 1 Titelbild, 3 Tafeln, 3 Sternkarten und 89 Abbildungen.

277C. Bohemian translation—S. Newcombova Astronomie pro Každého. Se svolením spisovatelovým volně přeložil Dr. Bohuslav Mašek.

Prague, J. Otto, 1909, 391 pp. + 5 plates (Portrait). Česká Knihovna zábavy a poučení. Vydává Ústřední spolek českých professorů. Pořádá František Bílý. Číslo 25. Translation of the London edition.

277D. Swedish translation—Newcomb Astronomi för Alla, en populär framställning av himmelsföreteelserna. Svensk bearbetning av Östen Bergstrand.

Stockholm, A. Bonnier, [1909], 10--308 pp.

"Vetenskap och Bildning ...," Band II. There were 3,000 copies in this edition, which was prepared for use as a textbook in the high-schools.

278. [Length of the tropical year.]

[Annals of the Central Chamber for Weights and Measures (Russian)], St. Petersburg, vol. 5 (1903): 84-88. Letter from Prof. Newcomb, translated into Russian, by F. Blumbach.

279. The universe as an organism. [Report of an address before the Astronomical and Astrophysical Society of America, Dec. 29, 1902.]

Science, New York, n. s. vol. 17 (Jan. 23, 1903): 121-129.

Also in Sci. Amer. Suppl., vol. 55 (Feb. 21, 1903): 22694-22696.

Also in Side-Lights on Astronomy (1906): 300-311; see no. 300 of this Section.

- 279A. French translation. L'univers comme organisme. Revue Scientifique, Paris, 4 s., vol. 19 (Mar. 14, 1903): 321-326.
- 279B. German translation (abridged). Das Weltall als einheitlicher Organismus. Astronomische Rundschau, Lussinpiccolo, Austria, vol. 5, no. 44 (1903): 113-119.
- 280. Present state and needs of astronomical research.

Carnegie Institution of Washington, Year Book, No. 1, 1902 (Jan. 1903): 147-152. Dated Washington, Oct. 8, 1902.

Appendix E to Report of advisory committee on astronomy, submitted by Simon Newcomb et al., pages 87-104.

281. On the desirableness of a reinvestigation of the problems growing out of the mean motion of the moon.

Mo. Notices R. Astr. Soc., vol. 63 (Mar. 13, 1903): 316-324.

- 282. The Reminiscences of an Astronomer. Boston, Houghton, Mifflin & Co. [Oct.], 1903, 12+424 pp. See also no. 230 of this Section, and no. 14 of Section I.
- 283. [The Moon Considered as a Planet, by James Nasmyth and James Carpenter.] Nation, New York, vol. 77 (Nov. 5, 1903): 368-369. Anonymous review.
- 284. The new problems of the universe. Harper's Mag., vol. 107 (Nov., 1903): 872-876. Also in Side-Lights on Astronomy (1906): 18-30; see no. 300 in this Section.
- 285. On the apparent extent of the illumination surrounding a new star on the hypothesis that it is reflected light.

Astr. Jl., vol. 23 (Nov. 25, 1903): 212.

286. "Asteroids," "Astronomy," "Astronomy: History," "Astronomy: Practical," "Astronomy: Theoretical," "Aurora Borealis," "Clock," "Geodesy," "Gravitation," "Horizon," "Mercury," "Parallax," "Refraction," "Saturn," "Scintillation," "Solar System," "Stars," "Sun," "Time," "Time: Measurement of," "Transits," "Universe," in Encyclopedia Americana, 22 volumes.

New York, Scientific American, 1904.

S. Newcomb was the "department and advisory editor" in astronomy for this work. In the 1920 edition of this *Encyclopedia* (in 30 volumes) the articles "Clock," "Gravitation," "Time," "Time: Measurement of" are unsigned; the article "Mercury" is signed by Eric Doolittle alone, and the articles "Horizon," "Parallax," "Refraction," "Scintillation," "Solar System," and "Transits" by Simon Newcomb alone; the others are signed by Newcomb with the added statement "Revised by Eric Doolittle."

#### 287. Wallace on life in the universe. Nation, New York, vol. 78 (Jan. 14, 1904): 34-35. Anonymous review.

- 288. [Note on Pickering and photographs of the moon.] Nation, New York, vol. 78 (Jan. 28, 1904): 71. Anonymous.
- 289. Stars variable and compound. Good Words, Edinburgh, vol. 45 (Mar., 1904): 217-219.
- 290. Remarks on the determination of the parallactic inequality of the moon. Mo. Notices R. Astr. Soc., vol. 64 (May, 1904): 570-571. Dated, Washington, May 11, 1904.
- 291. On the position of the galactic and other principal planes toward which the stars tend to crowd.

Carnegie Institution of Washington Contributions to Stellar Statistics, Washington (June, 1904), 32 pp. First paper. Publication No. 10. "Contribution to stellar statistics," first paper.

#### 292. The extent of the universe.

Harper's Mag., vol. 109 (Oct., 1904): 795-801.
Also in Side-Lights on Astronomy (1906): 60-65; see no. 300 in this Section.
Also in Scientific papers; physics, chemistry, astronomy, geology, with introductions, notes, and illustrations. New York, P. F. Collier & Son, vol. 30 (1910): 323-326.

#### 293. On the eclipse of Agathocles.

Mo. Notices R. Astr. Soc., vol. 65 (Dec. 9, 1904): 181-183. Also in Pop. Astr., vol. 13 (Apr., 1905): 199-201.

- 294. Aufforderung betr. Beobachtungen von Sternbedeckungen. Astr. Nach., vol. 167 (Jan. 17, 1905): cols. 79-80. Dated, Washington, Dec. 13, 1904.
- 295. Peters' catalogue.

The Observatory, London, vol. 28 (Apr. and Aug., 1905): 185-186; 322, Letters dated Feb. 6 and June 12, 1905.

#### 296. Life in the universe.

Harper's Mag., vol. 111 (Aug., 1905): 404-408. Also in Side-Lights on Astronomy (1906): 120-132; see no. 300 in this Section.

#### 297. An observation of the zodiacal light to the north of the sun.

Astrophysical Jl., vol. 22 (Oct., 1905): 209-212. In the Journal, vol. 23 (Mar., 1906): 168-169 is a "Note on Professor Newcomb's observations of the zodiacal light," by E. E. Barnard. This is followed by "Note by Professor Newcomb" (page 169).

298. Note on the astronomical value of ancient statements of solar eclipses.

Mo. Notices R. Astr. Soc., vol. 66 (Dec., 1905): 34-35. This note is followed by comments on the note by P. H. Cowell.

## 299. A compendium of spherical astronomy with its application to the determination and reduction of positions of the fixed stars.

New York and London, Macmillan Co., June, 1906, 18+444 pp.

"The present volume is the first of a projected series having the double purpose of developing the elements of Practical and Theoretical Astronomy for the special student of the subject, and of serving as a handbook of convenient reference for the use of the working astronomer in applying methods and formula." Preface.

- The following is an extract from a letter of Sir Robert Ball concerning his work on spherical astronomy (*Reminescences and letters of Sir Robert Ball*, edited by W. V. Ball, Bosten, Little, Brown (1915): 161-162): "I have seen no notice of my book except one in the *Scotsman*, and I have only had one letter on the subject which calls for any remark. It was from Professor Newcomb, who, as you know, has recently published a book on the same subject. He wrote:
- "It is very interesting to notice how completely the purpose of your work differs from that of mine. You treat the subject as an interesting branch of applied mathematics, while I have mostly in view the requirements of the working astronomer. "This extract will be a useful pellet, when I am accused, as of course I may be, of having stolen everything in the book, from
- Newcomb's work. Had I not this, I should merely have had to fail back on the stupid fact that ninety-nine per cent of my book was written before Newcomb's appeared. This being merely a truth would, of course, be no use in connection with the average 'review,'" Compare no. 154 of this Section.

About 1,020 copies of the work were printed and it is now out of print.

Reviewed in *The Observatory*, vol. 29 (Sept., 1906): 366-368.

Reviewed in Jl. British Astr. Assoc., vol. 17 (Oct., 1907): 44-45.

Reviewed in Phil. Mag., 6 s., vol. 15 (Apr., 1908): 570-571.

Reviewed in Nature, vol. 74 (Aug. 16. 1906): 379-380,

300. Side-lights on Astronomy and Kindred Fields of Popular Science: essays and addresses.

New York and London, Harper & Bros., 1906. 7+349 pp.+Portrait.

- CONTENTS: 1. The unsolved problems of astronomy (no. 241).
  2. The new problems of the universe (no. 284).
  3. The structure of the universe (no. 273).
  4. The extent of the universe (no. 292).
  5. Making and using a telescope (no. 127).
  6. What the astronomers are doing (no. 274).
  7. Life in the universe (no. 292).
  5. Making and using a telescope (no. 127).
  6. What the astronomers are doing (no. 274).
  7. Life in the universe (no. 292).
  5. Making and using a telescope (no. 127).
  6. What the astronomers are doing (no. 274).
  7. Life in the universe (no. 296).
  8. How the planets are weighed (no. 245).
  9. The mariner's compass (no. 125, Section V).
  10. The fairyland of geometry (no. 33, Section III).
  11. The organization of scientific research (no. 136, Section V).
  12. Can we make it rain. (no. 85, Section V).
  13. The astronomical Ephemeris and Nautical Almanac (no. 108).
  14. The world's debt to astronomy (no. 192).
  15. An astronomical Ephemeris and Nautical Almanac (no. 108).
  14. The world's debt to astronomy (no. 192).
  15. An astronomical knowledge (no. 216).
  18. Aspects of American astronomy (no. 220).
  19. The universe as an organism (no. 279).
  20. The relation of scientific method to social progress (no. 46, Section V).
  21. The outlook for the flying machine (no. 120, Section V).
  Up to July, 1920, about 4,650 copies of this work had been printed: In June, 1906, 2,500 copies; in October, 1909, 750; in February, 1914, 300; in June, 1920, 500. Over 500 copies were sold in England.
- 301. On Mr. Cowell's discussions of ancient eclipses of the sun. Mo. Notices R. Astr. Soc., vol. 64 (June, 1906): 470-472.
- 302. Development of the two principal non-secular terms in the radius-vector of a planet which are independent of the mean longitude of the disturbing planet. Astr. Jl., vol. 25 (Dec., 1906): 111-114.
- 303. On the action of the planets on the moon. Astr. Jl., vol. 25 (Feb. 26, 1907): 129-132.
- 304. [The sun's radiation.]

Science, New York, n. s., vol. 25 (May 24, 1907): 823-824.

305. The optical and psychological principles involved in the interpretation of the so-called canals of Mars.

Astrophysical Jl., vol. 26 (July, 1907): 1-17.

Cf. Enowledge and Scientific News, London, n. s., vol. 4 (Sept., 1907): 193-196.

- 306. Investigation of inequalities in the motion of the moon, produced by the action of the planets; by Simon Newcomb, assisted by Frank E. Ross. Carnegie Institution of Washington Publ. no. 72, Aug. 1907. 8+160 pp.
  - Reviewed in Nature, London, vol. 77 (Nov. 14, 1909): 43-44.
- 307. The loss of energy by the sun. The Observatory, London, vol. 30 (Oct. 1907): 384.
- 308. Note on the preceding paper [i. e. The canals of Mars, optically and psychologically considered, a reply to Professor Newcomb, by Percival Lowell.] Astrophysical Jl., vol. 26 (Oct. 1907): 141. "Reply to Professor Newcomb's note," page 142.
- 309. A search for fluctuations in the sun's thermal radiation through their influence on terrestrial temperature.

Trans. Amer. Phil. Soc., Philadelphia, n. s., vol. 21, pt. 5 (Mar. 1908): 309-387. Read Oct. 4, 1907.

- 310. Considerations on the form and arrangement of new tables of the moon. Mo. Notices R. Astr. Soc., vol. 68 (June, 1908): 538-544.
- 311. Fallacies about Mars. Harper's Weekly, vol. 52 (July 25, 1908): 11-12.
- Fluctuations in the moon's mean motion. Mo. Notices R. Astr. Soc., vol. 69 (Jan. 1909): 164-169.
- 313. Comparison of ancient eclipses of the sun with modern elements of the moon's motion. Mo. Notices R. Astr. Soc., vol. 69 (Mar. 1909): 460-467.
   A note by J. K. Fotheringham follows this paper.
- 314. La théorie du mouvement de la lune, son histoire et son état actuel. Revue générale des sciences pures et appliquées, Paris, vol. 19 (Sept. 15, 1908): 686-691. Also in Atti del IV. Congresso internazionale dei Matematici, Roma, Tipografia della R. Accademia dei Lincei, vol. 1 (1909): 135-143. Address as a vice president of the Congress. Also printed as a pamphlet, Roma, 1908, 10 pp.
- 315. Preface [to A. O. Leuschner's "Tables of minor planets discovered by J. C. Watson. Part I]."

Mem. Nat. Acad. Sci., vol. 10, seventh memoir (1910): 197. Preface signed by Simon Newcomb; dated Washington, 1908, March. 316. "Astronomy, Descriptive," "Astrophysics," "Comet," "Eclipse" (four of five sections), "Ecliptic," "Gravitation" (in part), "Jupiter: Satellites," "Latitude," "Light; Velocity," "Mars," "Moon," "Orbit," "Parallax," "Planet," "Planets: Minor," "Refraction: Astronomical Refraction." "Saturn," "Solar system," "Time: standard," "Uranus (astronomy)," "Venus (astronomy)," "Zodiacal light," in Encylopædia Britannica, 11th ed., 28 volumes.

Cambridge, University Press, 1910–1911; vol. 2 (1910): 800–808, 819; 6 (1910): 759–752, gdz.; 8 (1910): 891–895; 12 (1910): 384–385; 15 (1911): 564–565; 16 (1911): 267–268, 623–626; 17 (1911): 761–765; 18 (1911): 154–155, 802–807, pls.; 19 (1911): 385–387; 20 (1911): 164–165, 760–762; 21 (1911): 714–719, pls.; 23 (1911): 29; 24 (1911): 231–232; 25 (1911): 357–358; 26 (1911): 987–988; 27 (1911): 788–789, 1013–1014; 28 (1911): 903–1000.
See also nos. 151, 272.

317. Researches on the motion of the moon, Part II. The mean motion of the moon and other astronomical elements derived from observations extending from the period of the Babylonians until A. D. 1908.

Astr. Papers, vol. 9, pt. 1 (1912): 249 pp. Author's preface dated June 15, 1909. He died July 11, 1909. Part I was published in 1878; see there (no. 101)

Nore.—Since a new title, No. 180X, was inserted in this list, the total number of titles it this Section is 318.

#### SECTION III.

#### MATHEMATICS.

The titles of this section are listed under (a) Theory of probabilities and least squares, (b) mathematical texts, (c) miscellaneous. For other mathematical articles see Section II, nos. 102, 181, and 258; also Section V, no. 113.

#### (A) THEORY OF PROBABILITIES AND LEAST SQUARES.

Almost from the beginning of his scientific career, on to the closing years of his life, Simon Newcomb was intensely interested in questions involving the theory of probabilities, and in the subject of least squares. Such questions frequently occupied his leisure moments and had he been longer spared there is little doubt but that something more elaborate along these lines than he had yet published would have come from his pen. Among his MSS, there is considerable material on least squares. This seems to be preparatory to a text which should be one of a projected series, in which the compendium of spherical astronomy was the first work, "to cover as much of the field of practical and theoretical astronomy as I shall be able to deal with during the next few years." See under no. 299, Section II.

1. Notes on the Theory of Probabilities.

Math. Mo. (Runkle's), Cambridge, Mass., vol. 1 (Jan., 1859), 136–139; (Apr., 1859): 233–235; (July, 1859): 331–335, 349–350; vol. 2 (Jan., 1860): 134–140 (May, 1860): 272–275; vol. 3 (July, 1861): 68; (July, 1861): 119–125; (Aug. 1861): 341–349.

During the three years of its existence Runkle's Monthly consisted largely of problems proposed and solved. Prizes were offered for the best solutions and Simon Newcomb, W. P. G. Bartlett, and T. H. Safford were the judges.

2. "Solutions of problems in probabilities."

Math. Mo. (Runkle's), Cambridge, Mass., vol. 1 (July, 1859): 349-350.

3. Solution of Prize Question: "Two rods 2 and 4 feet long, respectively, having their middle points connected by a string 1 foot in length are thrown up; show that the chance of their crossing is  $\frac{1}{2} + 2/\pi^2$ ."

The Lady's and Gentleman's Diary, London, 1860, pp. 67-68.

4. On the objections raised by Mr. Mill and others against Laplace's presentation of the doctrine of probabilities.

Amer. Acad. Proc., Cambridge, Mass., vol. 4 for 1857-1860 (1860): 433-440.

5. [Solution of the problem: "Two great circles are drawn at random on a sphere. What is the probability that their mutual inclination, taken less than 90, will be contained between any given limits, as n and m?"]

Math. Mo. (Runkle's), Cambridge, Mass., vol. 3 (Dec., 1860): 68-69.

6. A mechanical representation of a familiar problem [in least squares].

Mo. Notices R. Astr. Soc., vol. 33 (Suppl., 1573): 573.
 Paper read before the Philosophical Society of Washington, June 7, 1873. "Note on a mechanical representation of some cases in the method of least squares" on page 574.

7. Note on the frequency of use of the different digits in natural numbers.

Amer. Jl. Math., Baltimore, vol. 4 (Jan., 1881): 39-40.

- A generalized theory of the combination of observations so as to obtain the best result. *Amer. Jl. Math.*, vol. 8 (Oct., 1886): 343-366. Reviewed in *The Observatory*, London, vol. 9 (Oct., 1886): 369-370.
- 9. Problem: "A pack of cards of any specification is taken—say that there are p cards marked 1, q cards 2, r cards 3, and so on—and, being shuffled, is dealt out on a table; so long as the cards that appear have numbers that are in descending order of magnitude they are

#### MATHEMATICS.

placed in one pack together—equality of number counting as descending order—but directly the descending order is broken a fresh pack is commenced, and so on until all the cards have been dealt. The probability that there will result exactly m packs or at most m packs is required."

Phil. Trans. R. Soc., London, series A, vol. 207 (Feb., 1908): 65.

Also in P. A. MacMahon, Combinatory Analysis, Cambridge, University Press, 1915, Section IV: "The Theory of Composition of Numbers," Chapter IV, "Simon Newcomb's Problem," pp. 187 f.

The problem occurs first in "Second Memoir on the Composition of Numbers" which Major MacMahon read before the Royal Society, Dec. 6, 1906. (The first memoir was read Nov. 24, 1892, and is to be found in the *Philosophical Transactions*, vol. 184 A, pp. 835-902.) The "problem under investigation" was brought to the Major's notice by Simon Newcomb to whomit was suggested by a game of "patience" played with ordinary playing cards which he found to be a recreation in the few hours that he could spare from astronomical work. See *The Observatory*, London, vol. 30 (Feb. 1907): 113

#### (B) MATHEMATICAL TEXTS.

#### 10. Algebra for Schools and Colleges. (Newcomb's Mathematical Series.)

#### New York, Holt, June, 1881. 8 vo. 11+454 pp.

Eleven other editions or reprints varying in size from 250 to 1,050 copies each, were printed as follows: Sept., 1881; Aug., 1882; Sept., 1883; Aug., 1884; July, 1885; Aug., 1887; Aug., 1888 (destroyed by fire); Feb., 1889; Aug., 1895; Dec., 1896; Aug., 1903. The number of copies printed in all twelve editions totaled 8,800. The number of pages in the latest revised edition was 14+546.

Although "Algebra for Schools and Colleges" is on the title-page of the various editions, on the back of the book the title is simply "College Algebra" which was later changed to "Algebra for Colleges."

This book was written for his daughter Anita, now Mrs. (Dr.) McGee, who studied it in MSS. as it was prepared. This was finally published, and a whole series of mathematical books followed.

The Answers have also been published separately in pamphlet form, New York, Holt, 1889, 25 pp.

#### 10A. Key to Algebra for Schools and Colleges. (Newcomb's Mathematical Series.)

New York, Holt [April], 1882. 8 vo. 283 pp.

The second edition published in July, 1885, contained 2+297 pp. The third and last edition appeared in Aug., 1889.

The total number of copies printed for all three editions was 750. In the preface occur the statements: "The greater part of this key has been prepared, and the proofs read, by Professors J. Howard Gore, of Columbian University, Washington, and J. W. Gore, of the University of Virginia. ... A few oral exercises on the principles taught in the opening book have been added for the practice of beginners in the subject."

#### 11. Elements of Geometry (Newcomb's Mathematical Course).

New York, Holt [August], 1881. 8+399 pp.

- Five other editions or reprints were printed, as follows: Dec., 1882; Sept., 1884: Aug., 1887; Dec., 1888 (670 copies destroyed by fire, also 300 copies of the old edition); July, 1891.
  - The number of copies printed in all six editions or reprints totaled 6,000; of these the number sold totaled 3,902. The number of pages in the latest revised edition was 10+399. See also under no. 13.
- 12. Elements of plane and spherical trigonometry with logarithmic and other mathematical tables and examples of their use and hints on the art of computation. (Newcomb's Mathematical Course.)

New York, Holt [April], 1882. 6+160+6+80+104 pp.

Seven other editions or reprints, varying in size from 250 to 1,225 copies each, were printed, as follows: Sept., 1882; Sept., 1883; May, 1887; March, 1889; Aug., 1893; May, 1898; March, 1902.

The number of copies printed in all of these editions or reprints totaled 3,975.

Elements of trigonometry [as a separate work]. 6+168 pp. 2,025 copies were printed in April, 1882, March, 1883, May, 1887, Feb., 1889, and Dec., 1906.

There was also issued as a separate work: Logarithmic and other mathematical tables, with examples of their use and hints on the art of computation. 6+80+104 pp. 12,258 copies were printed in April, 1882; Nov., 1882; April, 1886; May, 1887; March, 1880; Feb., 1892; Aug., 1893; Oct., 1895; Sept., 1896; May, 1898; July, 1901; Dec., 1905; June, 1908; Sept., 1912; Aug., 1914; June, 1916; July, 1918; July, 1919; June, 1921.

This is now the "best seller" among Newcomb's books; in 1921, 340 copies were sold.

13. Elements of plane geometry and trigonometry, with four-place logarithmic and trigonometric tables.

New York, Holt [September], 1882. 7+335 pp.

### 56 BIBLIOGRAPHY OF SIMON NEWCOMB—ARCHIBALD.

<ul> <li>14. A School Algebra. (Newcomb's Mathematical Course.) New York, Holt [June], 1882. 8+279 pp. There were six other editions or reprints, as follows: Aug., 1882; Aug., 1883; Oct., 1887; Nov., 1888; March, 1889; July, 1891. In all editions or reprints, 6,500 copies were printed. Answers were published separately in pamphlet form, for example in 1889, 25 pp.</li> </ul>
14A. Key to School Algebra. New York, Holt, Aug., 1883, another edition, Aug., 1889. Total number of copies printed, 500.
<ul> <li>15. Elements of analytic geometry. (Newcomb's Mathematical course.) New York, Holt [August], 1884. 8+357 pp. There were five other editions or reprints published in: Jan., 1885; July, 1885; Feb., 1889; Sept., 1892; Apr., 1895. In all editions or reprints the total number of copies printed was 4,000. "Added is a brief course of reading in geometry." Preface.</li> </ul>
<ul> <li>16. Essentials of trigonometry, plane and spherical, with three and four place tables, logarithmic and trigonometric. (Newcomb's Mathematical course.) New York, Holt [October], 1834. 6+187 pp. There were other editions or reprints in Sept., 1890, 1395, 1899. In all, 1,250 copies were printed; 100 copies were destroyed by fire.</li> <li>A few pages (167-187) were reprinted with cover title by W. H. Lowdermilk and Co., at Washington, in 1905, under the title: Three and four place logarithmic and trigonometric tables.</li> </ul>
<ul> <li>17. Elements of the differential and integral calculus. (Newcomb's Mathematical course.) New York, Holt [September], 1887. 12+307 pp. Other editions or reprints appeared in July, 1889, and Sept., 1892. In all editions or reprints, 2,150 copies were printed.</li> </ul>
(c) MISCELLANEOUS.
<i>Astr. Jl.</i> , vol. 5 (Apr. 2, 1858): 121–127.
19. Note on differentiation.
20. On the mathematical theory of heat in equilibrium. Math. Mo. (Runkle's), Cambridge Mass., vol. 2 (July, 1860); 346-354.
21. Investigation of the dynamical theory of gases. Amer. Acad. Proc., Cambridge, vol. 5, 1860–1862 (1861); 112–114.
22. [Note on Benjamin Peirce.] Nation, New York, vol. 18 (Mar. 5, 1877): 157. Anonymous.
<ul> <li>23. Elementary theorems relating to the geometry of a space of three dimensions and of uniform positive curvature in the fourth dimensions.</li> <li>Crelle's Jl., vol. 83 (1877): 293-299.</li> <li>"Full extracts of this very important contribution to noneuclidean geometry are given in the Encyclopædia Britannica, article 'measurement.'" Quotation from no. 4, Section I of this bibliography.</li> </ul>
<ul> <li>24. Note on a class of transformation which surfaces may undergo in space of more than three dimensions.</li> <li>Amer. Jl. Math., vol. 1 (1878): 1-4.</li> <li>One of the results found is: "If a fourth dimension were added to space a closed material surface (or shell) could be turned inside out by simple flowner: without either stretching or tearing."</li> </ul>
25. The fundamental definitions and propositions of geometry with special reference to the syllabus of the Association for the Improvement of Geometrical Teaching. [A. I. G. T.] Nature, vol. 21 (1880): 293-295.
26. Show that $\log\left(1-\frac{2\eta}{1+\eta^2}\cos x\right) = -\eta^2 + \frac{\eta^4}{2} - \frac{\eta^6}{3} + \cdots + 2\eta \cos x - \frac{1}{2} 2\eta^2 \cos 2x$

$$-\frac{1}{3} 2\eta^{3} \cos 3x - \cdots = \sum_{i=1}^{i=\infty} \text{Thus:} (-1)^{i} \frac{\eta^{2i}}{i} - \sum_{i=1}^{i=\infty} \frac{2\eta^{i}}{i} \cos ix$$

Math. Questions with solutions from the Educ. Times, London, vol. 36 (1881): 116; Question no. 6859.

### MATHEMATICS.

27.	Remarks on the doctrine of limits. Analyst. Des Moines, Jowa, vol. 9 (July, 1882); 114-115.
28.	<ol> <li>The teaching of mathematics, Elementary Mathematics; (2) Mathematical teaching. Educ. Rev., New York, vol. 4 (Oct., 1892): 277-286; vol. 6 (Nov., 1893): 332-341.</li> </ol>
29.	Modern mathematical thought. Bull. N. Y. Math. Soc., vol. 3 (Jan. 1894): 95-107. Also in Nature, London, vol. 49 (Feb. 1, 1894): 325. An address delivered before the N. Y. Mathematical Society at its annual meeting, Dec. 28, 1893.
29A	Rivista di matematica (Peano), vol. 4 (1894): 121–134.
30.	The philosophy of hyperspace. Science, n. s., vol. 7 (Jan. 7, 1898): 1-7. Also in Sci. Amer. Supp., vol. 45 (Feb. 12, 1898): 18450-18451. Also in Bull. Amer. Math. Soc., vol. 4 (Feb. 1898): 187-195. Also in Pop. Astr., vol. 6 (Sept., 1898): 380-389. Presidential address before the American Mathematical Society, Dec. 29, 1897.
31.	Note [on being elected editor in chief]. Amer. Jl. Math., vol. 20 (April, 1899).
32.	Professor Thomas Craig, Ph. D. [Died May 8, 1900]. Amer. Jl. Math., vol. 22 (1900), one unnumbered page. Appended to the sketch is the note: "The writer is indebted to Dr. L. P. Eisenhart for part of the material on which this notice is based."
33.	The fairyland of geometry. Harper's Mag., vol. 104 (Jan., 1902): 249-252. Also in: Side-lights on Astronomy (1906); see no. 300 of Section II.
34.	An account of Professor Runkle's Mathematical Monthly. Amer. Math. Mo., Springfield, Mo., vol. 10 (May, 1903): 130-133.
35.	Methods of teaching arithmetic. Educ. Rev., New York, vol. 31 (Apr., 1906): 339-350.

Also in Nat. Educ. Assoc. Proc. (1906): 686-99.

## SECTION IV. ECONOMICS.

1.	A critical examination of our financial policy during the southern rebellion. New York, Appleton, 1865. 222 pp.
	Reviewed [by F. Bowen], N. A mer. Rev., New York, vol. 100 (Apr., 1365): 601-613. This work was published at Newcomb's own expense. Since the author was an unknown young man whose name on the title-page was given simply as "Simon Newcomb," all of the edition was not sold
2.	Our financial future. N. Amer. Rev., vol. 102 (Jan., 1866): 100–135. Anonymous.
3.	[Peto's Taxation.] N. Amer. Rev., vol. 104 (Jan., 1867): 255–261.
4.	The let-alone principle. N. Amer. Rev., vol. 110 (Jan., 1870): 1-33.
5.	The labor question. N. Amer. Rev., vol. 111 (July, 1870): 122-125.
6.	Baxter's National Debts. N. Amer. Rev., vol. 114 (Jan., 1872): 189–193.
7.	Jevon's Theory of Political Economy. N. Amer. Rev., vol. 114 (Apr., 1872): 435–440. By "S. N."
8.	The session. N. Amer. Rev., vol. 117 (July, 1873): 182–223. Anonymous review of work, especially financial, in Congress.
9.	Treasury and public opinion. Nation, New York, vol. 18 (June 4, 1874): 358–359. Anonymous editorial.
10.	Thompson's National Economy. Nation, New York, vol. 20 (May 13, 1875): 333-335; vol. 21 (July 15, 1875): 41. Anonymous review, and note on the "Industrial League," Philadelphia.
11.	The method and province of political economy. N. Amer. Rev., vol. 121 (Oct., 1875): 241-270.
12.	[Jevon's Money, and the Mechanism of Exchange.] Nation, New York, vol. 21 (Dec. 16, 1875): 390-391. Anonymous review.
13.	The ABC of finance, or The money question familiarly explained to every-day people in nine short and easy lessons. <i>Harper's Weekly</i> , Lessons I-III, vol. 19 (Dec. 18, 1875): 1018-1019; lessons IV-V, vol. 19 (Dec., 25):1042- lessons VI-VII, vol. 20 (Jan. 1, 1876): 10; lessons VIII-IX, vol. 20 (Jan. 8): 30-31.
13A	. The ABC of finance; or, The money and labor questions familiarly explained to common
	people, in short and easy lessons. New York, Harpers, s. d. [c. 1877], pp. 7-115. Another edition, 1878, pp. 7-115.
	<ul> <li>Harper's Half-Hour Series, vol. 3?</li> <li>Proface: "A part of these 'lessons' appeared some time since in <i>Harper's Weekly</i>. The unexpected favor with which they were received, by being reprinted, in whole or in part, by newspapers in various sections of the country, has suggested their reproduction in a more permanent form. They are now completed, by the addition of several chapters bearing on the labor questions of the present day."</li> <li>There are fifteen lessons in the book which had a large sale.</li> </ul>
14.	Price on Currency and Banking. Nation, New York, vol. 21 (Dec. 30, 1875): 420-421. Anonymous review.
15.	Walker on The Wages Question. Nation, New York, vol. 23 (July 6, 1876): 12–13. Anonymous review.

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- 16. Shadwell's System of Political Economy. Nation, New York, vol. 24 (June 28, 1877): 385-386. Anonymous review. 17. Walker on Money. Nation, New York, vol. 26 (Apr. 11, 1878): 244-245. Anonymous review of a work published in 1878. 18. The silver conference and the silver question. International Rev., New York, vol. 6 (Mar., 1879): 309-333. 19. The standard of value. N. Amer. Rev., vol. 129 (Sept., 1879): 233-237. 20. Walker's Money [in its relation to Trade and Industry.] Nation, New York, vol. 29 (Sept. 18, 1879): 197-198. Anonymous review of a work published in 1879. 21. The organization of labor. Princeton Rev., New York, (May, 1880): 393-410; (Sept., 1880): 231-246. 22. Principles of taxation. N. Amer. Rev., vol. 131 (Aug., 1880): 142-156. 23. The two schools of political economy. Princeton Rev., New York, n. s., vol. 14 (Nov., 1884): 291-301. 24. Principles of political economy. New York, Harper's, 1886 [c. 1885]. 16+548 pp. Reprinted in 1887, 1890, and 1895. In all 2,500 copies were printed. Reviewed in Science, New York, vol. 6 (Nov. 27, 1885): 470-471, by E. J. James. Reviewed in Nation, New York, vol. 42 (Jan. 14, 1886): 38-39. Listed with comment in Sonnenschein's Reader's Guide. See also no. 33, Section I, of this bibliography. 25 Newcomb's Political Economy. Science, New York, vol. 6 (Dec. 4, 1885): 495. Letter in reply to criticisms in James's review, no. 24 (above). 26. Views of economists on the silver question. Science, New York, vol. 7 (Mar. 19, 1886): 265-266. 27. The labor problem. Independent, New York, vol. 38 (Mar. 25, 1886): 358. 28. An economist's advice to the Knights of Labor. Nation, New York, vol. 42 (Apr. 8, 1886): 292-293. Anonymous editorial. 29. A plain man's talk on the labor question. Independent, New York, vol. 38 (May 13-Sept. 9, 1886). "Society as a cooperative organization" (May 13): 581-582; "Railway monopoly" (May 20): 613; "Our common interests" (May 27): 646-647; "Benefits and evils of organized action" (June 3): 680; "How one man may do the work of ten thousand" (June 10): 718; "Was it good for us that we allowed one man to make a hundred million dollars?" (June 17): 748; "The past and the present of the mechanic" (June 24): 782; "The account current-answers to questions" (July 1): 811-812; "A talk to a Knight of Labor" (July 15): 877=878; "More of the railroad question" (July 29): 942-943; "Another talk to a Knight of Labor" (Aug. 12): 1006; "How can all get better wages?" (Aug. 19): 1036-1037; "Cheap labor and its effects" (Aug. 26-Sept. 2): 1067-1068, 1103; "Is waste a good?" (Sept. 9): 1133-1134; "The moral side of the question" (Sept. 16): 1165. 29A. A plain man's talk on the labor question. New York, Harpers, 1886, 16 mo., 195 pp. Preface: "The following chapters owe their inception to the editor of the New York Independent, in which journal the outlines of most of them have recently appeared. They are now recast, amplified, and submitted to the courteous consideration of the reader." The edition of this book contained 1,500 copies.
  - Listed with comment in Sonnenschein's Reader's Guide.
  - 30. Aspects of the economic discussion.

Science, New York, vol. 7 (June 18, 1886): 538-542.

Also in Science Economic Discussion, New York. The Science Company, 1886. Paper no. 5, pp. 57-67.

- 31. Can economists agree upon the basis of their teachings?
  - Science, New York, vol. 8 (July 9, 1886): 25-26.

## 60 BIBLIOGRAPHY OF SIMON NEWCOMB—ARCHIBALD.

32. What is a friend of labor?
Nation, New York, vol. 43 (Sept. 30, 1886): 265-266. Anonymous editorial.
33. Dr. Ely on the labor movement.
Nation, New York, vol. 43 (Oct. 7, 1886): 293-294. Anonymous review of R. T. Ely's The Labor Movement in America.
34. Soap-bubbles of socialism.
N. Amer. Rev., vol. 150 (May, 1890): 563-571.
35. The money question.
<ul> <li>The Sun, Baltimore, vol. 109 (May 22-July 3, 1891).</li> <li>"Professor Simon Newcomb on popular delusions. Too much of a good thing" (May 22): 1, 1½ cols.; "Prof. Newcomb discusses the philosophy of currency. What gives money its value second article" (June 18): suppl., 1½ cols.; "Free coinage really means not silver but certificates. A dollar note for eighty cents third article" (June 27): suppl., 1½ cols.; "Prof. Newcomb's fourth article. Paper money discussed. Bank notes merely promises to pay" (July 3): suppl., 1½ cols.</li> </ul>
36. The economists and the public.
Nation, New York, vol. 52 (June 15, 1891): 510–511. Anonymous editorial.
37. New-school political economists.
Nation, New York, vol. 53 (July 9, 1891): 27.
A letter dated Wash., July 3, 1891.
38. The problem of economic education.
Q. Jl. Econ., Cambridge, vol. 7 (July, 1893): 375-399.
Also issued in pamphlet form. Boston, G. H. Ellis & Co., 1893. 27 pp.
39. Has the standard gold dollar appreciated?
Jl. Polit. Econ., vol. 1 (Sept. 1893): 503–512.
40. [Review of R. T. Ely's Introduction to Political Economy, and Outlines of Political Economy.] Jl. Polit. Econ., vol. 3 (Dec., 1894): 106-111.
41. The basis of economics as an exact science.
Science, New York, n. s., vol. 21 (Mar. 24, 1905): 447-449.
42. Employer's liability.

Nation. New York, vol. 82 (May 31, 1906): 440-441. Anonymous editorial.

## Section V.

## MISCELLANEOUS. \_\_\_\_\_

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1.	[Review of J. P. Cooke's Elements of Chemical Physics.] Math. Mo. (Runkle's), Cambridge, Mass., vol. 3 (Oct., 1860): 30. Anonymous.
2.	Carey's Principles of Social Science. N. Amer. Rev., vol. 103 (Oct., 1866): 573-580.
3.	International copyright. N. Amer. Rev., vol. 114 (Apr., 1872): 432-435. Anonymous.
4.	Borderland of science. Nation, New York, vol. 18 (Mar. 12, 1874): 177. Anonymous review.
5.	District investigation. Nation, New York, vol. 18 (June 25, 1874): 407-408. Anonymcus.
6.	[Note on the American Association for the Advancement of Science.] Nation, New York, vol. 19 (Aug. 20, 1874): 123. Anonymous.
7.	Exact science in America.
	N. Amer. Rev., vol. 119 (Oct., 1874): 286-308. Review and extracts in "Editor's Table, Professor Newcomb on American Science." Pop. Sci. Mo., vol. 6 (Dec., 1874): 338-244.
8.	[Note on the Edinburgh Quarterly.] Nation, New York, vol. 19 (Oct. 29, 1874): 285–286. Anonymous.
9.	Life insurance. International Rev., vol. 2 (May, 1875): 353-370.
10.	[Note on the Galaxy for January.] Nation, vol. 22 (Jan. 6, 1876): 9–10. Anonymous.
11.	Abstract science in America, 1776–1876. N. Amer. Rev., vol. 122 (Jan., 1876): 88–123.
12.	Review of Croll's Climate and Time with especial reference to the physical theories of climate maintained therein. Amer. Jl. Sci., 3. s., vol. 11 (Apr., 1876): 263-273. Dated Wash., Feb. 21, 1876. The work referred to in the title was by James Croll and published at New York in 1875. See no. 57 of this Section.
13.	Who are friends of negro suffrage? Nation, New York, vol. 24 (Jan. 25, 1877): 53-54. Anonymous editorial.
14.	[Notes on Admiral Davis.] Nation, New York, vol. 24 (Mar. 1, 1877): 133-134. Anonymous.
15.	Life insurance failures. Nation, New York, vol. 24 (Mar. 15, 1877): 157-158. Anonymous editorial.
16.	[Note on the Smithsonian Institution Reports for 1876.] Nation, New York, vol. 25 (Oct. 11, 1877): 223. Anonymous.
17.	What the party wants.
	Nation, New York, vol. 25 (Dec. 13, 1877): 360. Anonymous editorial.

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18. [Review of Our Inheritance in the Great Pyramid, by C. P. Smyth.] Nation, New York, vol. 25 (Dec. 27, 1877): 400. Anonymous. 19. Professor Joseph Henry. Nation, New York, vol. 26 (May 16, 1878): 320-321. Anonymous editorial. 20. Education at the naval academy. Nation, New York, vol. 26 (June 20, 1878): 400-401. Anonymous editorial. 21. [Note on railway time.] Nation, New York, vol. 26 (June 20, 1878): 405. Anonymous. 22. An advertisement for a new religion. N. Amer. Rev., vol. 127 (July-Aug., 1878): 44-60. 23. [Remarks on taking the chair as president of the American Association for the Advancement of Science and his reply to speeches of welcome.] Amer. Assoc. Proc., Salem, vol. 26, 1877 (1878): 374, 377-378. 24. The course of nature: an address delivered before the American Association for the Advancement of Science, St. Louis, Aug. 22, 1878. By Simon Newcomb, retiring president of the Association. Amer. Assoc. Proc., Salem, vol. 27, 1878 (1879): 1-28. Also in Independent, vol. 30 (Sept. 5, 1878): 5-8, with the title "Simplicity and universality of the laws of nature." Also in Kansas City Rev., vol. 2, (Sept.-Oct., 1878): 356-367; 392-396. Also in Pop. Sci. Mo. Suppl., no. 18 (Oct., 1878): 481-493. Also in Jl. Sci., London, 3. s., vol. 1 (1879): 64-89. 25. [Note on the Woodruff expedition.] Nation, New York, vol. 27 (Nov. 28, 1878): 334. Anonymous. 26. Draper's Scientific Memoirs. Nation, New York, vol. 28 (Jan. 16, 1879): 55-56. Anonymous. 27. [Note on the Princeton Review.] Nation, New York, vol. 28 (Jan. 23, 1879): 70. Anonymous. 28. Law and design in nature. N. Amer. Rev., vol. 128 (May, 1879): 537-542. 29. Why are Republicans hopeful? Nation, New York, vol. 28 (May 15, 1879): 330. Anonymous editorial. 30. Evolution and theology—a rejoinder. N. Amer. Rev., vol. 128 (June, 1879): 647-663. 31. Politicians and State rights. Nation, New York, vol. 28 (June 26, 1879): 430-431. Anonymous editorial. 32. Sentimentalism in politics. Nation, New York, vol. 29 (July 31, 1879): 70-71. Anonymous. 33. [Note—"Confessions of an Agnostic" in the current number of the N. Amer. Rev.] Nation, New York, vol. 29 (Sept. 4, 1879): 158. Anonymous. 34. American Association for the Advancement of Science. Nation, New York, vol. 29 (Sept. 4, 1879): 150. Anonymous. 35. [Note on lightning rods.] Nation, New York, vol. 29 (Oct. 30, 1879): 292.

Anonymous.

- **36.** [Note on Maxwell.] Nation, New York, vol. 29 (Dec. 11, 1879): 403-404. Anonymous.
- 37. The religion of to-day. N. Amer. Rev., vol. 129 (Dec., 1879): 552-569.
- 38. [Notes on the Bureau of Education.] Nation, New York, vol. 30 (Jan. 8, 1880): 28. Anonymous.
- 39. Our political dangers. N. Amer. Rev., vol. 130 (Mar., 1880): 261-279.
- 40. Biographical memoir [of Joseph Henry. An address read before the National Academy of Sciences, April 21, 1880. (With "a supplementary note")] in A Memorial of Joseph Henry, "published by order of Congress." Washington, Gov't print. off., 1880, pp. 441-473.
  - Compare no. 144 of this Section. Also in Smithsonian Misc. Coll., no. 356, vol. 21 (1881): 441-473. Also in Biographical Mem. Nat. Acad. Sci., vol. 5 (1905): 1-35.
- 41. [Clark's Geodesy.] Nation, New York, vol. 30 (June 10, 1880): 441-442. Anonymous review.
- 42. The plan of the bosses at Chicago. Nation, New York, vol. 30 (June 17, 1880): 449-450. Anonymous editorial.
- 43. General Garfield and Credit Mobilier. Nation, New York, vol. 30 (June 24, 1880): 467–468. Anonymous editorial.
- 44. Signal service succession. Nation, New York, vol. 31 (Dec. 2, 1880): 389-390. Anonymous.
- 45. Modern scientific materialism.

Independent, New York, vol. 32 (Dec. 9, 1880): 1, cols. 1-3, The question stated; vol. 32 (Dec. 23, 1880): 1, cols. 1-4, Correlation of mental and material phenomena; (Dec. 30): 3, cols. 1-3, The possible endowments of matter; vol. 33 (Jan. 13, 1881): 3, cols. 2-4, Thought as a form of force; (Jan. 27): 2-3, cols. 3-4, 1-2, Vital action.

- 46. The relation of scientific method to social progress. An address delivered [as president] before the Philosophical Society of Washington, Dec. 4, 1880.
  Washington, Judd & Detweiler, 1880, 15 pp.
  Also in Bull. Phil. Soc. Wash., vol. 4 (1881): 40-52.
  Also in Smithsonian Misc. Coll., Wash., vol. 25.
  Also in Side-lights on Astronomy (1906): 312-329; see Section II, no. 300.
- 47. [Notes on time and B. F. Ishenwood.] *Nation*, New York, vol. 32 (May 5, 1881): 316-317. Anonymous.
- 48. [Note on P. Earl Chase.] Nation, New York, vol. 32 (June 30, 1881): 459-460. Anonymous.
- 49. Copyright.

New York Tribune (Oct. 22, 1881): 8, col. 1.

- 50. Letter to Prof. Krueger, containing suggestions respecting the international telegraphic code.
  - Vierteljahrsschrift Astr. Gesell., vol. 16 (Oct., 1881): 349-350. Dated Wash., Sept. 6, 1881.
- 51. Speculative science.

International Rev., vol. 12 (Apr., 1882): 334-341. A review of J. B. Stallo's Concepts and Theories of Modern Physics.

52. Reports of officers of the navy on the ventilating and cooling of the executive mansion during the illness of President Garfield. By Simon Newcomb and others. Washington, Gov't print. off., 1882. 13 pp. 53. A visit to Cetywayo. Harper's Mag., vol. 66 (Apr., 1883): 86-89. This visit to the deposed king of Zululand was made while S. Newcomb was in Cape Colony for the 1882 transit of Venus. 54. The watchmaking industry in Switzerland. Science, vol. 1 (Apr. 20, 1883): 296-297. Letter dated Nouchatel, March 12, 1883, and signed S. N. 55. The units of mass and force. Science, Cambridge, vol. 2 (Oct. 12, 1883): 493-494. The psychological mechanism of direction. **5**6. Science, Cambridge, vol. 2 (Oct. 26, 1883): 554-556. 57. On some points in climatology. A rejoinder to Mr. Croll. Amer. Jl. Sci. 3. s., vol. 27 (Jan., 1884): 21-26. Also in Phil. Mag., London, 5. s., vol. 17 (Feb., 1884): 142-143. Mr. Croll replies, pp. 275-281. A rejoinder to Mr. Croll's reply (Phil. Mag., Oct., 1883) to Newcomb's criticisms of his theory; see no. 12 of this Section. 58. What is a liberal education? Science, Cambridge, vol. 3 (Apr. 11, 1884): 435-436. Also in Nature, vol. 30 (May 1, 1884): 9-10. 59. Hasty naval legislation. Nation, New York, vol. 38 (May 29, 1884): 461. Anonymous editorial. 60. President Eliot on a liberal education. Science, Cambridge, vol. 3 (June 13, 1884): 704-705. 61. [Reply by "Ed. Nation" to letter criticising Hasty naval legislation, no. 59 (above).] Nation, New York, vol. 38 (June 19, 1884): 526. Anonymous. 62. [Review of G. G. Stokes' On the Nature of Light.] Nation, New York, vol. 38 (June 19, 1884): 534. Anonymous. 63. Psychic force. Science, Cambridge, vol. 4 (Oct. 17, 1884): 372-374. 64. Psychical research. Science, Cambridge, vol. 4 (Dec. 5, 1884): 510-511. Letter in reply to one by E. Gurney on psychical research. 65. Can ghosts be investigated? Science, Cambridge, vol. 4 (Dec. 12, 1884): 525-527. 66. The Georgia wonder-girl and her lessons. Science, New York, vol. 5 (Feb. 6, 1885): 106-108. 67. Mortality experiences of the Connecticut Life Insurance Company. Science, New York, vol. 5 (May 8, 1885): 379-380. 68. Annual address of the president of the American Society for Psychical Research, Jan. 12. 1886. [On thought-transference.] Boston (?), 1886, 24 unnumbered pages. 69. The telephone case. Nation, New York, vol. 42 (Jan. 21, 1886): 50. Anonymous editorial. 70. Professor Newcomb's address before the American Society for Psychical Research. Science, vol. 7 (Feb. 12, 1886): 145-146. Letter; see no. 68 of this Section. 71. Responsibility in the Navy Department. Nation, New York, vol. 42 (Feb. 25, 1886): 164. Anonymous editorial. 72. The condition of the Coast Survey. Nation, New York, vol. 42 (Mar. 11, 1886): 208-209.

Anonymous editorial.

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73.	The telephone suit. Nation, New York, vol. 42 (Mar. 18, 1886): 230–231. Anonymous editorial.
74.	Mischievous philanthropy. Forum, vol. 1 (June, 1886): 348-357.
75.	The work of the congressional commission on the surveys. Nation, New York, vol. 42 (June 17, 1886): 502. Anonymous editorial.
76.	Some critics of the Geological Survey. Nation, New York, vol. 43 (July 6, 1886): 26–27. Anonymous editorial.
77.	Science and immortality. The Christian Register Boston, vol. 66 (Apr. 7, 1887): 211.
78.	The reappearance of an old boss. Nation, New York, vol. 45 (July 21, 1887): 46-47. Anonymous editorial.
79.	Concerning Higgins. The Evening Post, New York (Sept. 18, 1887). Anonymous, "From an occasional correspondent." Dated Washington, September 12.
80.	The speed of propagation of the Charleston earthquake discussed by S. Newcomb and C. E. Dutton. Amer. Jl. Sci., 3. s., vol. 35 (Jan., 1888): 1-15.
81.	On the definitions of the terms "energy" and "work." Phil. Mag., London, vol. 27 (Feb., 1889): 115-117.
82.	Michel Eugène Chevreul. Nation, New York, vol. 48 (Apr. 18, 1889): 320-321. Anonymous editorial.
83.	Utilizing the power of Niagara. Nation, New York, vol. 49 (Aug. 8, 1889): 104-105. Anonymous editorial.
84.	A remarkable judicial decision. The Evening Post, New York (Nov. 18, 1889). Also in Nation, New York, vol. 49 (Nov. 21, 1889): 404-405. Anonymous editorial.
85.	<ul> <li>Can we make it rain? By General Robert G. Dyrenforth and Professor Simon Newcomb. N. Amer. Rev., vol. 153 (Oct., 1891): 398-404.</li> <li>Also in L. Gathman, Rain produced at will. Chicago, 1891, 61 pp.</li> <li>Also in Side-Lights on Astronomy (1906): 182-190; cf. no. 300 in Section II.</li> <li>This provoked the pamphlet entitled: Should the rainfall experiments be continued? A criticism of Prof. Simon Newcomb's contribution to the article in the North American Review entitled, "Can we make it rain?" By Edward Powers, Delaware, Wisc., 1892. 15 pp. The first paragraph of the "criticism" contains the following sentence: "His arguments are so superficial, so inconsistent, and so unscientific, both in their allegations and their methods, that they ought not to be allowed to pass unanswered." This pamphlet was, apparently, an insert for a revised edition of Powers's book War and The Weather, 1890.</li> </ul>
86.	Government rain-making. Nation, New York, vol. 53 (Oct. 22, 1891): 309-310. Anonymous editorial.
87.	Standard dictionary of the English language prepared by more than two hundred specialists and other scholars 2 vols. New York, Funk & Wagnalls Co., 1893–1895. S. Newcomb was a member of the "editorial staff" under "Astronomy, mathematics, and physics."
<b>8</b> 8.	Naval administration. Nation, New York, vol. 56 (Mar. 2, 1893); 154–155. Anonymous editorial.
89.	Suggested nomenclature of radiant energy. Nature, vol. 49 (Nov. 30, 1893): 100.
90.	A French view of Franklin as a diplomatist.

Nation, New York, vol. 57 (Dec. 14, 1893): 447. Letter signed "S. N."

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91.	Kidd's Social Evolution. Nation, New York, vol. 58, (Apr. 1894): 294. Anonymous review.
92.	The elements which make up the most useful citizen of the United States. Amer. Anthropologist, Washington, vol. 7 (Oct., 1894): 345-351. By "Aristides" (=S. Newcomb) who was the winner of the first prize, \$150 of two "Citizenship Prizes" offered in 1893 by the Anthropological Society of Washington for the best essay on the topic of not over 3,000 words in length.
93.	To our readers. Science, n. s. vol. 1 (Jan. 4, 1895) : 1-2. Newcomb was the member of the "Editorial Committee" of Science dealing with "mathematics."
94.	Why we need a national university. N. Amer. Rev., vol. 160 (Feb., 1895): 210.
95.	Report of the Watson trustees on the award of the Watson medal to Seth C. Chandler for the Nat. Acad. Sc., by Simon Newcomb, B. A. Gould, A. Hall. Science, New York, n. s. vol. 1 (May 31, 1895): 477-481.
96.	A Shepherd ovation. Nation, New York, vol. 61 (Nov. 14, 1895): 340-341. Anonymous editorial.
97.	The wreck of the Columbia: a story. Harper's Mag., New York, vol. 93 (Aug., 1896): 466-475. S. Newcomb's first essai in the domain of fiction. His other romances are nos. 110 and 118.
98.	French universities and American students. Nation, New York, vol. 63 (Nov. 26, 1896): 400-401. Dated Wash., Nov. 21, 1896.
<b>99.</b>	<ul> <li>International Conference on a Catalogue of Scientific Literature by S. Newcomb and J. S. Billings.</li> <li>Washington, Govt. print. off., January, 1897, 2 pp. 54th Congress, 2d session, Senate Document no. 43, pp. 2-3. Report dated Wash., Oct. 15, 1896.</li> <li>Also in The Smithsonian Institution documents relative to its origin and history, Washington, vol. 2 (1901): 1770-1771.</li> </ul>
100.	The American Educator, a Library of Universal Knowledge, 6 vols. Philadelphia, Syndicate Publishing Co., 1897. S. Newcomb is referred to as one of the 11 "associate editors and special contributors." See no. 143, in this Section.
101.	France as a field for American students. Forum, vol. 23 (May, 1897): 320-326. Same condensed in Public Opinion, New York, vol. 22 (May 20, 1897): 629.
101A	. French Translation—La France comme champs d'études pour les Américains. Revue Internationale de L'Enseignement, vol. 34 (July, 1897): 20–27.
102.	Science during the Victorian era. Independent, New York, vol. 49 (June 17, 1897): 774-775.
103.	[Review of C. Flammarion's Lumen.] Nation, New York, vol. 65 (Dec. 9, 1897): 463–464. Anonymous; written by Mr. and Mrs. S. Newcomb.
104.	Naval reorganization. Nation, New York, vol. 65 (Nov. 25, 1897): 411-412. Anonymous editorial.
105.	Two naval scientific bureaus, I. The hydrographic office; II. The naval observatory. The Evening Post, New York, Jan. 14-Jan. 19, 1898): 1 col.+1 col. Anonymous editorials.
106.	The naval officer. Nation, New York, vol. 67 (Aug. 11, 1898): 105. Anonymous editorial.
107.	The possibilities of invention.
	Independent, New York, vol. 51 (Apr. 13, 1899): 1005-1007.
108.	Has telepathy been established? Independent, New York, vol. 51 (June 29, 1899): 1730–1733.
109.	Science and government.

N. Amer. Rev., New York, vol. 170 (May, 1900): 666-678.

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- 110. His Wisdom, the Defender: a story. New York, Harper Bros., Oct., 1900. 7+328 pp. Reviewed in Nation, vol. 71 (Dec. 6, 1900): 452. The edition of this work contained 1,544 copies. It is out of print.
- 111. Is the airship coming?
  - McClure's Mag., New York, vol. 17, (Sept., 1901): 432-435.
- 112. The problem of aerial flight. Boston Evening Transcript, Nov. 16, 1901. Also in The Evening Star, Washington, Nov. 16, 1901. The title of the article as it appeared in The Star was somewhat different.
- 113. "Action and reaction," "Axiom" (in part), "Calculus," "Capacity" (in physics), "Centre of mass or gravity," "Centrifugal force," "Density," "Dynamics," "Energy," "Equilibrium," "Ether," "Extension" (in physics), "Finite" (in mathematics), "Force," "Geometry,". "Gravitation," "Impenetrability," "Inertia" (in physics), "Infinite" (in mathematics), "Infinitesimal" (in mathematics), "Infinity," "Kinetic," "Kinetics," "Latent heat," "Limits" (in mathematics), "Mass" (in physics), "Matter," "Measurement," "Mechanical equivalent" (of heat), "Mechanics," "Mobility," "Movement" (of force), "Momentum," "Motion and rest" (in physics), "Nebular hypothesis," "Parallelogram of forces," "Perpetual motion," "Personal equation," "Physical science," "Opint" (in geometry), "Potential," "Ptolemaic theory," "Resultant," "Space" (in mathematics), "Statics," theory (in science), "Unit" (of physical measurement), "Value" (in physical science), "Variable (and constant) quantity," "Vibration," "Vis viva," "Work." in Dictionary of Philosophy and Psychology, edited by J. M. Baldwin.

New York, Macmillan, vol. 1, A-L, 1901; vol. 2, M-Z, 1902.

- All of the above-mentioned articles are signed "S. N.," one of the "contributors" in "Physical Sciences and Mathematics."
- 114. The metric system of weights and measures. [To fix standard of weights and measures by adoption of metric system.]
  - Washington, Gov't print. off., 1902.

Report of a hearing on the metric system before the Coinage, Weights and Measures Committee, Feb. 6-Mar. 6, 1902, 57th Congress, 1st session. S. Newcomb's statements made on Feb. 8, 1902, are reported on pp. 70-74.

115. Conditions which discourage scientific work in America.

N. Amer. Rev., vol. 174 (Feb., 1902): 145-158.
 See Rev. of Reviews (English edition), vol. 25 (Mar., 1902): 262.

116. Shall we raise a statue to Shepherd?

Nation, New York, vol. 75 (Oct. 23 1902): 321-322. Anonymous editorial.

- 117. Congrès international des savants à l'Exposition universelle de Saint-Louis, 19-25 septembre, 1904. Discours prononcés à un diner donné par M. S. Newcomb, président du Congrès, à quelques savants de France, 29 Mars. 1903.
   [Paris, Impr. A. Boutillier, 29 Juillet, 1903.] pp. 10.
- 118. The end of the world: a story.

McClure's Mag., New York, vol. 21 (May, 1903): 3-14.

- 118A. Japanese translation by Kuroiwa Ruiko in daily newspaper Yorodzu Choho, Tokyo (May 6-25, 1904).
  - Translation arranged in alternate paragraphs with the English was published as a book of 90 pages, with the following dedication: "To Dr. Anita McGee this humble translation of her father's valuable work is most respectfully dedicated by the translator, who wishes to offer hearty thanks for her practical sympathy for our nation and to erect a slight monument in memory of her merciful deeds in this country by this translation." Dr. McGee had charge of the American nurses who gave their services to the Japanese Government for six months of 1904, during the Russo-Japanese war.
- 119. Shall we dismember the Coast Survey?

Nation, New York, vol. 77 (Oct. 1, 1903): 260. Anonymous.

- 120. The outlook for the flying machine. Independent, vol. 55 (Oct. 22, 1903): 2509-2512. Also in Side-Lights on Astronomy (1906): 330-345; see Section II, no. 300.
- 121. The functions of the Senate. Nation, New York, vol. 77 (Nov. 12, 1903): 375-376. Anonymous.

122. The Senate's appointing power. The Evening Post, New York, Nov. 12, 1903.

123. [In A favorite quotation of mine, a calendar published by the King's Daughters, Binghamton,

New York, 1903, we find under March 24, 1904, page 38: "Whatsoever thy hand findeth to do, do it with thy might, Simon Newcomb."]

#### 124. The Carnegie Institution.

N. Amer. Rev., vol. 178 (Feb., 1904): 172-135. Also an extract in Science, vol. 19 (Feb. 12, 1904): 263-269.

125. The mariner's compass.

Harper's Mag., vol. 108 (Feb., 1904): 422-427. Also in Side-Lights on Astronomy (1906): 140-154; see Section II, no. 300.

126. A statistical inquiry into the probability of causes of the production of sex in human offspring.

Carnegie Institution, Washington, Publication No. 11.
 Washington, June, 1904, 34 pp.
 Quoted on pages 501-503 of J. A. Thomson, Heredity, London, Murray, 1908.

127. The coming International Congress of Arts and Sciences at St. Louis, Sept. 19-24. Pop. Sci. Mo., vol. 65 (Sept., 1904): 466-473.

# 128. The evolution of the scientific investigator. [Introductory address delivered as president of the International Congress of Arts and Science at the St. Louis Exposition, Sept. 19, 1904.] In Congress of Arts and Science, Universal Exposition, St. Louis, 1904, edited

by H. J. Rogers, volume 1.

Boston and New York, Houghton, Mifflin & Co., 1905, pp. 135-147.

Also in Science, vol. 20 (Sept. 23, 1904): 92-96.

Also in Sci. Amer. Suppl., vol 58 (Oct. 2, 1904): 24098-24100.

Also in Pop. Sci. Mo., vol. 66 (Nov., 1904): 92-96.

Also as a pamphlet, St. Louis, Universal Exposition, 1904, 24 pp.

Also ("reprinted from author's revised copy") Smithsonian Report, 1904, Washington, 1905, pp. 221-233. Also in Side-Lights on Astronomy (1906): 236-257; see Section II, no. 300.

Also in Engineering Education, Essays for English, selected and edited by R. P. Baker, New York, Wiley (1919): 3-28.

- 129. [Letter dated January 19, 1903, signed by Simon Newcomb, chairman, and six others, the "Committee on Plan and Scope" for the Congress of Arts and Science, University Exposition, St. Louis, 1904; in Congress of Arts and Science, ed. by H. J. Rogers.] Boston and New York, Houghton, Mifflin and Co., vol. I, (1905): 8-10.
- 130. Our antiquated method of electing a president. N. Amer. Rev., vol. 180 (Jan., 1905): 9-18.
- 131. [Method by which the Carnegie Institution can best promote research work in the exact sciences.]

Carnegie Institution of Washington Year Book, no. 3, 1904. Washington (Jan., 1905): 179-181. Letter dated, May 12, 1904.

- 132. The Smithsonian Institution. Nation, New York, vol. 80 (June 29, 1905): 516-517. Anonymous editorial.
- 133. The cost of life insurance business. Nation New York, vol. 81 (July 6, 1905): 67. Anonymous.
- 134. Walking in Switzerland. Nation, New York, vol. 81 (Sept. 28, 1905): 256–257. Signed "S. N.," dated "On the Rhine, Aug. 7, 1905."
- 135. What the navy needs. Nation, New York, vol. 81, (Dec. 28, 1905): 516-517. Anonymous.
- 136. The organization of scientific research.
  N. Amer. Rev., vol. 182 (Jan., 1906): 32-43.
  Also in Side-Lights on Astronomy (1906): 165-181; see Section II, no. 300.

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## MISCELLANEOUS.

137. [American Metrological Society, by Simon Newcomb and James H. Gore.] Medical Notes and Queries (edited by Henry W. Cattel), vol. 2 (Mar., 1906): 60-61. Communication dated Washington, Mar. 12, 1906, appealing "for aid in promoting the progress of the metric system"; signed by S. Newcomb as chairman of the legislative committee and J. E. Gore as secretary of the Society.
138. Our navy. N. Amer. Rev., vol. 182 (Mar., 1906): 321–322. Anonymous, by "An American Citizen."
<ul> <li>139. University athletics.</li> <li>N. Amer. Rev., vol. 185 (June 21, 1907): 353-364.</li> <li>Also in College and the Future; Essays for the Undergraduate on Problems of Character and Intellect. Edited by R. A. Rice. New York, Scribner, 1915.</li> <li>One of 18 articles.</li> </ul>
140. The prospect of aerial navigation. N. Amer. Rev., vol. 187 (Mar., 1908): 337-347.
141. The problem of aerial navigation. Nincteenth Century, vol. 64 (Sept., 1908): 430-442. Also in Living Age, vol. 259 (Oct. 24, 1908): 195-205.
142. Awaits the inevitable hour. Nation, New York, vol. 87 (Nov. 5, 1908): 437. Letter dated, Washington, Oct. 28, 1908. On Dr. Rolf amending the reading in Gray's "Elegy."
<ul> <li>143. How an encyclopaedia may be edited.</li> <li>Nation, New York, vol. 87 (Nov. 19, 1908): 492.</li> <li>Letter dated Washington, Nov. 7, 1908. It repudiates any connection whatever as "editor" of the Twentieth Century Encyclopaedia, Philadelphia, Syndicate Publ. Co., 1906, which seems to be simply another edition of The American Educator published by the same company in 1897, and for which S. Newcomb may have written a couple of articles. The title page of the latter work refers to him as one of the "associate editors and special contributors."</li> </ul>
144. Modern occultism.
Nineteenth Century, vol. 65 (Jan., 1909): 126–139.
<ul> <li>Also in Living Age, vol. 260 (Feb. 13, 1999): 387-398.</li> <li>This provoked "Attitude of science to the unusual" by O. Lodge, Nineteenth Century, vol. 65 (Feb., 1909): 206-222; also in- Living Age, vol. 250 (Mar. 20, 1909): 707-719. Cf. "Science and the supernatural," New York Sun (Feb. 21, 1909). See also Section I, no. 80.</li> </ul>
145. Joseph Henry, physicist, 1797-1878, in Leading American Men of Science, ed. by D. S.
Jordan.
New York, Holt, 1910. pp. 119-146. Compare no. 40 in this Section and no. 46 in Section I. A number of paragraphs in the former are the same as in the sketch above.
146. The metric system of weights and measures. Why it should be adopted in the United
States.
Washington, American Metrological Society, n. d. 6 pp. It is signed T. C. Mendenhall, president; J. H. Gore, secretary; S. Newcomb, chairman of the publication committee. This report must have been published before 1902, since Mendenhall resigned the presidency of the society in 1901. Compare no. 114 of this Section.
NUMBER OF TITLES.
Section II. Astronomy