SIMON NEWCOMB

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WHEN Simon Newcomb died in 1909, he was universally mourned as America's most eminent scientist. The Royal Society of London had given him its highest honour, the Copley Medal, and the French Academy of Sciences had elected him Foreign Associate in succession to Helmholtz. The United States, the land of his adoption, had granted him every honour it had to bestow.

In view of all this, it is strange that few in this province know that Newcomb was born in Nova Scotia and spent the first eighteen years of his life in the Maritime Provinces. Such lack of honour in his own country is the more surprising since it is of intellectual achievement that a Nova Scotian is most prone to boast. He may be able to restrain himself modestly when speaking of a fellow-countryman's success in business or in statesmanship; but when it comes to scholarship, his reticence is sorely tried.

Perhaps one reason for this neglect of Newcomb is that his work was in the abstruse subject of mathematical astronomy. Only the specialist would be interested in the majority of his writings, a partial list of which covers twenty-two closely printed pages. A wide appeal, however, is made by his *Reminiscences of an Astronomer*, written in the closing years of an eventful life. The layman might be tempted to open its pages to learn something of that curious human variety, the great mathematician. He would find a very entertaining book, written by a practised hand in a pleasing style. Newcomb's outlook was not confined to astronomy, nor his friendship to scientists. He travelled widely in the course of his work, and met many eminent men. He wrote at first hand of the American Civil War, and deciphered old manuscripts in Paris during the Commune. In Gibraltar he first met that distinguished fellow-countryman, Sir Fenwick Williams of Kars. Gladstone, John Stuart Mill, and Lord Lister were among his friends.

The book, however, is much more than a collection of anecdotes. It is essentially a human story of perseverance crowned by success. Of humble birth, Newcomb grew up in an atmosphere unappreciative of education. He was almost entirely self-taught, and books were rare. He was without friends of influence, and received no encouragement to study. Courage, singleness of purpose and

sheer hard work opened for him the door to astronomy. They remained lifelong qualities which contributed as much to his greatness as did his native ability.

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The earlier chapters of the *Reminiscences* are perhaps the best, for they are frank autobiography. They are doubly interesting to Nova Scotians, for they give a vivid picture of life in this province in the middle of the last century. Simon Newcomb was born in Wallace, Nova Scotia, on the twelfth of March, 1835. His father's forebears came originally from New England. His grandfather, Simon L. Newcomb, taught school in Pictou for a short time in 1802, and married a daughter of Matthew Harris, one of the first settlers in that town. His maternal grandfather was "Squire" Thomas Prince, a man of some standing in Moncton, N. B.

His father was a country schoolteacher, who seldom remained more than one or two years in the same place. He was described by his son as the most rational and dispassionate of men. His method of seeking a wife was unique. From careful study he had learned that the age at which a man should marry was twenty-five. As he found that age approaching, he set forth on foot to find a wife who should be mentally gifted, of temperament different from his own, and an economical housekeeper. "In those days the professional tramp and mendicant were unknown, and every farmhouse dispensed its hospitality with an Arcadian simplicity little known in our times. Wherever he stopped overnight he made a critical investigation of the housekeeping, perhaps rising before the family for this purpose." In vain had the search extended nearly a hundred miles when, early one evening, he reached the then small village of Moncton. "He was attracted by strains of music from a church, went into it, and found a religious meeting in progress. His eye was at once arrested by the face and head of a young woman playing on a melodeon, who was leading the singing. He sat in such a position that he could carefully scan her face and movements. As he continued this study, the conviction grew upon him that here was the object of his search. That such should have occurred before there was any opportunity to inspect the housekeeping may lead the reader to conclusions of his own. He enquired her name—Emily Prince. He cultivated her acquaintance, paid his addresses and was accepted.....The marriage was in all respects a happy one, so far as congeniality of nature and mutual regard could go." Here is a son's tribute:

> My mother was the most profoundly and sincerely religious woman with whom I was ever intimately acquainted, and my father always entertained and expressed the highest admiration for her mental gifts, to which he attributed whatever talents his children might have possessed. The unfitness of her environment to her constitution is the saddest memory of my childhood. More I do not trust myself to say to the public, nor will the reader expect more of me.

His father tried his fortune in a number of places. A year was spent in Bedeque, P. E. I., and another at Yarmouth. There were several periods of residence at Wallace with his paternal grandfather. His father's ideas of education did not coincide with those prevalent in the communities where he taught. Apparently the ability to recite glibly the rules of arithmetic and grammar was prized more highly than the power to cipher correctly or write grammatically.

Newcomb was rather a precocious boy. He could read the Bible at the age of six, and was early interested in arithmetic. He seems to have been left pretty well to his own devices. Books because they were scarce were read the more thoroughly. They included a book on phrenology, Combe's *Constitution of Man,* and some volumes of the *Spectator*. One or two books on navigation and a sort of popular science came his way, and one on Natural Philosophy was read surreptitiously after hours in the schoolhouse. An old Euclid opened out a new world of thought to young Newcomb. In it was the first conception of mathematical proof that he had ever met with, and he became so enraptured as to think that such methods of reasoning should be clear and pleasing to all.

At the age of thirteen he was hired out by his father to a farmer, partly on account of poverty, and partly from fear that the boy might overstudy. When he reached sixteen, it was necessary to seek regular employment. The only opportunity seemed to be the trade of a carpenter, when chance opened a new and alluring prospect. While at his mother's home in Moncton he heard glowing reports of a wonderful physician, living nearby at Salisbury, who effected cures of the sick that had been given up by other doctors. Better still, this doctor wanted a pupil of some kind. An interview took place with the doctor, whom Newcomb found charming and magnetic. His conversation had an intellectual flavour. Mental food, he said, was as much a necessity to him as his daily bread. A bargain was soon struck, providing that Newcomb should live with the doctor, helping him in preparing medicines and attending to business, while the doctor on his part should supply Newcomb's bodily needs and teach him the "botanic system of medicine."

It was not long before it began to dawn upon Newcomb that he had fallen in with a quack. The doctor's magnetic charm and intellectual conversation were evidently reserved for impressing his patients, for there was no sign of them at home. His family was harsh and overbearing, and the expected library was non-existent. A request for books wherein to study the doctor's vaunted system of medicine resulted in his being given the very book on phrenology he had read as a child. The only instruction he received was the advice to follow the doctor's own philosophy, which was that "this world is all a humbug, and the biggest humbug is the best man."

After two years of misery, the apprentice decided to run away. He left a letter to explain that as the doctor had shown no intention of fulfilling his promises, he on his part felt that the agreement was annulled. Starting out on foot before daybreak, he covered fifty miles on the road to Saint John, narrowly escaping capture by the doctor who had set out in pursuit. After nightfall he reached a house where he was hospitably entertained. "Thus ended a day," he writes, "to which I have always looked back as the most memorable of my life."

He reached Saint John to find a celebration in progress marking the commencement of work on the first railway in the province. There followed a week whose hardships he refuses to describe. Penniless, he worked his way in a small sailing vessel to Salem, and from there made his way to Maryland where he found work as a country school teacher.

So ended Newcomb's life in these provinces. In spite of the hardships and discouragement he underwent, he gives an unbiassed picture of the social background of his early days. Everything necessary to daily life had to be made on the spot, and even at home. The spinning wheel and the loom were part of the furniture of every house, while the work of the men was from daylight till dark. Newcomb showed little skill in the work on a farm, and was looked down upon in consequence. He felt keenly his inability to drive oxen, and to master the vocabulary associated with their handling.

Clearly this was a lad of parts, who "had more larnin' than all the people around here put together." Yet no future was held out to him other than manual labour. No minister, teacher or other educated man seems to have encouraged him to study, or helped him along the well-known paths to scholastic success. Moreover, his experience was not confined to one locality, but extended over three provinces. That it should so happen must raise doubts as to the quality of early education in this country. Though proud

to claim Simon Newcomb as a Nova Scotian, we must regret that his genius was not early recognized.

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The first four years of his life in the United States were those of a wandering country school teacher. By degrees he was able to buy a few books, chiefly on mathematics. It was characteristic of the youth that he chose to follow mathematics as the study for which he felt he was most fitted, though he did not see how he could turn it to account. He had gradually formed the idea that there existed a different kind of world from that in which he was living, "a world of sweetness and light—where dwelt men who wrote books and people who knew the men who wrote them—where lived boys who went to college and devoted themselves to learning, instead of driving oxen."

His first glimpse into that new world was in the Smithsonian Library while on a visit to Washington. "Here I was delighted to find the greatest treasure that my imagination had ever pictured—a work that I had thought of almost as belonging to fairyland. And here it was right before my eyes"—four enormous volumes of Laplace's "Méchanique Céleste."

It was in the Smithsonian Institution that he first made the acquaintance of a "real live professor" in the person of its great Secretary, Professor Joseph Henry. With his aid Newcomb was able to leave the"world of cold and darkness", and enter into the new world he was later to adorn. He began as a computer in the office of the "American Ephemeris and Nautical Almanac" in Cambridge, Mass., in 1857. The nature of his duties allowed him to enroll at Harvard, where with practically no formal instruction he obtained a degree in less than two years.

His first important original work was on the asteroids. These numerous minor planets occupy a gap in the regular order of the planets between Mars and Jupiter, and the hypothesis had inevitably been made that they were the remains of a large planet shattered by some sort of explosion in a past epoch. Newcomb calculated the orbits of several asteroids far back into the past, and was able to show that they had never passed through a common point of intersection, thus disproving the hypothesis. This work of a self-taught man of twenty-five instantly won European recognition.

In 1861 he moved to Washington, where the remainder of his life was spent in the work of a Government astronomer. He was appointed one of the Professors of Mathematics in the United States Navy. This curious corps was the product of Government red tape, to

furnish astronomers for the Naval Observatory. Incidentally Newcomb held at his retirement the honorary rank of Rear-Admiral in the United States Navy. Universities have vied with one another in giving honorary degrees to Admirals, but for a scholar to receive such naval honours must surely be unique.

For some years Newcomb took part in observational work. He went on several eclipse expeditions, and observed the rare phenomenon of the transit of Venus at the Cape of Good Hope. He was consulted in the erection of many great telescopes, and his attendance on international commissions made him a familiar figure in Europe. His chief interest, however, lay on the side of theoretical astronomy, and his appointment in 1877 to superintend the Nautical Almanac Office left him free to carry out his plans.

Newcomb's most important work dealt with the orbits of the planets and with the moon's motion. One of the greatest tasks of mathematical astronomy is to account for the observed motions of the planets, and to calculate their future courses. A striking example of successful calculation was the discovery of the planet Neptune, whose existence was predicted almost simultaneously by Leverrier and Adams. The basis of all calculations in this field is Newton's law of gravitational attraction. If only two celestial bodies are involved, say the sun and the earth, the problem can be solved exactly. The presence of another planet creates the famous "problem of three bodies" which has never been solved exactly. Actually there are nine planets, and the motion of each around the sun is perturbed by all the others. The complexity of the problem of planetary motions is enormous—a single formula may fill a whole chapter. It can be solved only by successive approximations, and final correctness can never be arrived at.

Reliable observations on which calculations must be based have been made regularly only in comparatively recent times. Nevertheless they are very numerous, and their accuracy has constantly increased with improving methods and apparatus. Many great astronomers had improved the solution of the problem of planetary motions, but no one had used more than a small part of the ever increasing bulk of observations. Moreover, a great diversity of fundamental constants had been adopted in drawing up their tables. It seemed to Newcomb that the time was ripe for unification. The gigantic task he set himself was the building up on a homogeneous basis of the theory and tables of the whole planetary system, using all available data. This task he completed with the notable assistance of G. W. Hill.

The theory of the moon's motion is another of the problems of celestial mechanics which has always attracted astronomers. To this theory Newcomb contributed many important new methods. No less important were his researches into old astronomical records. For an object whose position is changing so rapidly as that of our satellite, it is important that the record of its motion should cover as long a time as possible. Newcomb found a perfect mine of information in the old manuscripts of the Paris Observatory. The record was generally to the effect that at a certain time a certain star was obscured by the moon. Unfortunately it was usually written in hieroglyphics peculiar to the observer, the type of instrument was not stated, the clock might have been in error by many minutes, and the very identity of the star was often uncertain. With rare judgment and skill Newcomb sifted these observations, and found many to be serviceable. It has been stated that we owe solely to him such knowledge as we have of the moon's motion in the whole century preceding 1750.

He seems to have had quite a flair for historical discovery. A most interesting case was his vindication of Father Hell, S.J., who had observed the transit of Venus in 1761. It had long been argued that Father Hell had falsified his observations, the principal evidence being certain apparent erasures in his original records at Vienna, discovered by Littrow. The reader must be referred to the *Reminiscences* for the complete story of how Newcomb's suspicions were aroused, how his examination of the manuscript in Vienna disclosed that no erasures had been made, and how he showed that Littrow had been led into error by colour-blindness.

Newcomb was wonderfully versatile. He was a first-class experimenter, as was proved by his laboratory determination of the velocity of light. His value for this classical constant of experimental physics was far in advance of previous work. He had great gifts as a writer. His *Popular Astronomy* passed through many editions, and was translated into several languages. Finding his daughter studying an algebra which he thought unsuitable, he wrote each evening her lesson for the next day. This was the origin of a whole series of mathematical books. He was a frequent contributor to the better class popular magazines of his day. Indeed, he even wrote a novel, but there is no record of its reaching a second edition. A life-long interest in economics led to his writing a text-book of Political Economy, as well as many articles on that subject.

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Newcomb retired on reaching the age limit in 1897, but his investigations went on until his death on the eleventh of July, 1909. Medals, prizes, degrees and honorary memberships had been showered upon him until the possibilities were literally exhausted. He held the Doctorate from Cambridge, Oxford, Leyden, Heidelberg, Harvard, Yale, and many others. It may seem surprising that, while his name is not associated with any brilliant discovery, he achieved as great a reputation abroad as was ever gained by an American scientist. Perhaps the secret lies in the unity of purpose which characterized all his efforts. His work has been adjudged to reveal an unusual combination of skill and originality in mathematical treatment, an unfailing patience and skill in dealing with immense masses of numerical results, and a talent for observation of the highest order.

Newcomb's work may be said to mark a culminating point in the astronomy of position. More recently the solar system has ceased to be the centre of astronomical interest. Astro-physics has become a full-fledged science dealing with the constitution, temperature and age of the stars. The magnitude of the distant nebulae revealed by the huge modern telescopes has dwarfed into insignificance the solar system to which we belong.

To the reader of recent popular books on cosmology, it must seem a far cry to the abstruse and refined calculations on which Newcomb spent a lifetime. Yet celestial mechanics will ever remain of interest. The very recent discovery of the new planet Pluto may remind us that the subject is not exhausted. Refinements of observation will bring in their turn further improvement of planetary tables. Never again, however, will one man be able to master the solar system in its entirety as did Newcomb.

In his humble beginnings and hard-won education, in his character and steadfastness of purpose, and in the greatness of honours attained, Newcomb closely resembles Benjamin Franklin. It may be said of him, as it has so often been said of Franklin, that no finer example of ambition and industry could be offered to youth. Certainly the inspiring story of Newcomb's life should not be forgotten in his native land.