

John Tyndall

XV. JOHN TYNDALL

1820-1893

BIOGRAPHICAL STUDY

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A brief presentation of the main facts of Tyndall's life will make it easier to set forth the main significances of his life:—John Tyndall was born in the village of Leighlin-Bridge, county of Carlow, Ireland, August 21, 1820. He claimed descent from that early reformer, William Tyndale, who first translated the New Testament into English, and who was burned at the stake for heresy in 1536. His father, who because of some difference with his grandfather had received no patrimony and was in humble circumstances, was a man of great independence of character—a quality in which his famous son was also distinguished—and in his way, too, a man of great ability and acquirements, being, indeed, an ardent theological controversialist, with all the opinions and doctrines of the fathers of the English church at his fingers' ends. Young Tyndall himself was schooled in theological controversy, but, what was better, he was also schooled in the teachings and literature of the Bible. Because of his theological

knowledge his father used frequently to call him "Stillingfleet," after the learned English divine of that name. What is of more significance, however, is that he used frequently to call him "Newton," because of his interest in seeking to get at the causes of natural phenomena. Mr. Tyndall's only formal education was obtained at a school near Leighlin, where, however, he remained until he was nineteen, his father in this respect doing the very best he could for him. He then obtained employment upon the Irish Ordnance Survey. He remained in this service for five years. During the second year of his service an incident occurred that was the turning point of his life. A kind-hearted official in the service, noticing that young Tyndall had considerable spare time on his hands, one day inquired of him how he employed it. The reply showing that it was not spent very satisfactorily, the official impressively said: "You have five hours a day at your disposal. This time ought to be devoted to systematic study. Had some friend advised me in this way when I was your age I should now be at the head of the Survey." Tyndall took the hint. The very next morning he was at his books at 5 o'clock, and "for twelve years he never swerved from that practice." He was then in his twenty-first year.

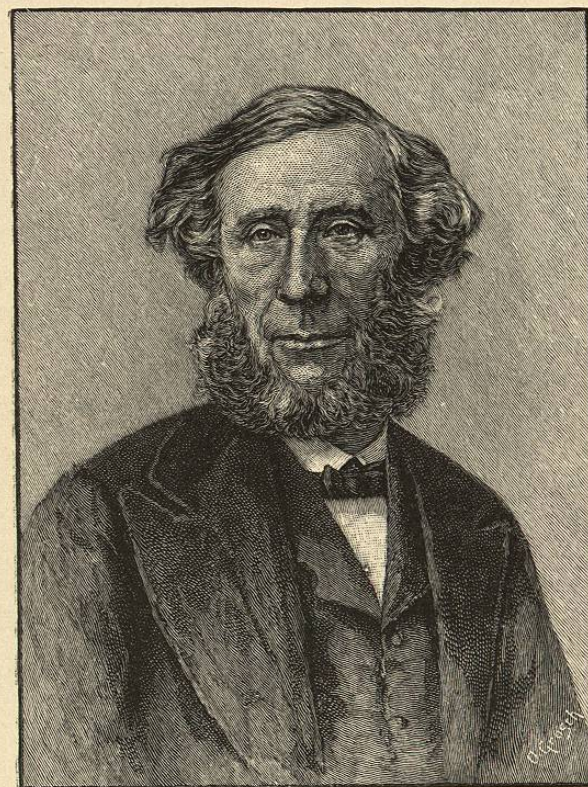
Mr. Tyndall's career in the Ordnance Survey was very characteristic. He made himself master of every duty that was intrusted to him, and the consequence was that he rapidly rose through all the grades of the service—draughtsman, surveyor, computer, trigonometrical surveyor, etc.—as far, indeed, as a young man like him, without influence or special training, could possibly rise. Seeing in the service, however, no future for him, he after five

years' trial quitted it. Railway construction being then a mania in Britain he became a railway engineer. After three years' work at this business, still feeling that he had not yet got at his life's vocation, he became a teacher in Queenswood College, Hampshire, an institution devoted to technical education in agriculture and engineering. Here, indeed, he did find what seemed to be his life's work; but he soon recognized that he was not sufficiently well prepared to pursue it properly. Accordingly, though his work in Queenswood was eminently successful, he resigned his position after one year's service, and went to Germany to attend the University of Marburg in Hesse-Cassel, the celebrated physicist, Bunsen, then being there. In making this move he had but one object, the perfecting of his natural powers as well as he could so that he might best do the work in life that might afterward open up for him to do. "I had been reading Fichte and Emerson and Carlyle, and had been infected by the spirit of these great men. The alpha and the omega of their teaching was loyalty to duty. Higher knowledge and greater strength were within the reach of the man who unflinchingly enacted his best insight. It was a noble doctrine. It held me to my work."

Mr. Tyndall remained in Marburg until he obtained his degree—two years. His store of money was very small. He had never had much chance of earning anything. When he was on the Ordnance Survey, even after four or five years' service, his salary was only twenty shillings (\$5) a week. But he had managed to accumulate some savings and to enjoy life as well. "I have often since wondered," he said many years afterward (in 1884), "at the amount of genuine happiness which a young fellow

of regular habits, not caring for either pipe or mug, may extract even from pay like that." So that he got through his two years at Marburg upon a sum that would to-day be scarcely more than enough to give most young men a good vacation trip. Then he went to Berlin, where he pursued his studies in the laboratory of Professor Magnus. In 1851 he returned to London, where he became acquainted with Faraday. He had already prepared some scientific papers of merit, and he was soon elected a fellow of the Royal Society. And now the second turning point in his life occurred. He was invited, at Faraday's suggestion, to give a "Friday Evening" lecture at the Royal Institution. The lecture was given February 14, 1853. It proved to be a pronounced success. The audience, the governors, Faraday himself, were all delighted. Mr. Tyndall was at once offered the position of Fullerian professor of physics at the Institution, and in June he entered upon his new duties. He was then scarcely thirty-three. A few years later (in 1861) when Faraday retired from his active charge of the Institution, Mr. Tyndall took upon himself the duty of supervisor; and when, in 1867, Faraday died, Mr. Tyndall succeeded to his office as director. His connection with the Royal Institution continued for thirty years, and then he, too, had to retire owing to ill-health, brought on by overwork. His life thenceforward until the end was that of an invalid.

Mr. Tyndall married late in life, but his marriage was an unspeakable blessing to him. In a letter to Mr. Herbert Spencer, written some half-dozen years before his death, "in referring," to use Mr. Spencer's words, "to Mrs. Tyndall's self-sacrificing care of him," he said: "She has raised my ideal of the possibilities of human



JOHN TYNDALL.

nature." To use the words of Professor Huxley, another of Mr. Tyndall's intimate friends, "her whole life for many years was devoted to the one object of preserving that of her husband." She had been "his secretary, his nurse, his tireless watcher—even his servant in case of need." "If I pull through this it will be all your care, all your doing," were the grateful words he addressed her the night before he died. Unfortunately, the very next morning, Mrs. Tyndall gave her husband a large dose of chloral, instead of some sulphate of magnesia which she had intended giving him. Everything that medical science or skill could do, of course, was done to avert the tragic consequences of this sad mistake; but to no avail. He died in ten hours—at 6:30 p. m., December 4, 1893.

Mr. Tyndall's great merit as a scientist did not lie in the number or magnitude of his scientific discoveries. Though these were neither few nor unimportant, he was not a great original scientific investigator like Faraday or Davy. Nor was he a great scientific law-giver like Darwin or Dalton. But perhaps more than any one else of his time he was seized with a clearness of view as to the limits of the scientific domain. Perhaps more than any one else did he seek to make those limits clearly visible to others. He recognized the region where physics ends and metaphysics begins, and he was outspoken in his assertions that many problems concerned with the constitution of the universe are insoluble. And this was true, in spite of the fact that he had a poet's nature, and loved to extend, by way of analogy or illustration, the certain laws of physical fact to the explanation of metaphysical uncertainties. But only by way of analogy or illustration; for no man's sense of logic was stronger. It was this clearness of view as to

matters of positive knowledge, joined to his power of illustration, and to his faculty for seizing upon and making use of analogies, which made him the popular teacher and lecturer he was. In the Royal Institution he had a difficult standard to maintain. His predecessors, Davy and Faraday, had been the most skillful scientific expositors in Europe. Tyndall's merit in this respect was on the whole quite the equal of theirs. While, perhaps, he did not possess in full degree their faculty of original scientific insight, he surpassed both of them in the clearness of view he had of the educational conditions of scientific teaching. So that while a lecture by Davy or Faraday was sure to delight, to astonish, and to impress, a lecture by Tyndall was sure to instruct.

In fact, it is upon his work as a teacher or instructor in science that Mr. Tyndall's claim to enduring fame most solidly rests. His knowledge of his own specialties—heat, light, magnetism, electricity, and sound—was as minute and profound as that of any man of his time. His original investigations in these specialties placed him in the rank of the foremost scientists of his age, even if they did not quite lift him above that rank. When, therefore, he came to instruct either classes or popular audiences, or, through his books, the general public, he was listened to and read, not as an ordinary teacher, but as a teacher bearing the mandates of authority and original investigation. But apart from his knowledge and his power of original insight, Mr. Tyndall was no ordinary teacher. He possessed what only the best teachers possess, that influence over his students which is called personal magnetism. But even this was not his distinguishing quality. It was something far more peculiar and distinctive. It was the in-

sight, then almost new to the world, that led him to see that good teaching takes place only when the comprehension of truth is effected by natural development—from the familiar to the unfamiliar, the concrete to the abstract, the simple to the complex. And even this was not all. He made his pupils actual explorers with himself in the realm of physical phenomena. He awakened within them their own powers of investigation. He exercised them in that faculty of constructive imagination which was his own distinguishing faculty, not merely as a scientific explorer but also as a scientific experimenter and instructor.

Fortunately for the world and for his enduring fame, a great part of Mr. Tyndall's educational work was effected by means of the books he wrote. His "*Heat as a Mode of Motion*," first published in 1863, has almost every merit that a scientific textbook should have, except the merit of being of much use to any one who wishes to quickly cram for a written examination. Besides it had, at the time of its first appearance, the additional merit of bringing under general consideration a doctrine, then but little known or indeed believed in—the great fundamental doctrine that the totality of energy in the universe remains forever the same; that energy can never be created and never be destroyed, but only changed from one form to another; that heat is but one form of energy, just as electricity, light, magnetism, etc., are also forms; that all forms of energy are interchangeable; and that the particular form of energy which we call heat is a motion of the elementary molecules of matter. He was thus able to bring our conceptions of many of the simplest and commonest phenomena of nature under the domain of a great, all-pervading, ever-existing law. But what Mr. Tyndall did for the

study and teaching of heat he also did, only in a more marked degree, for the study and teaching of light, and electricity, and sound. A sentence or two of his own will explain the ideals that he had in mind in the preparation of his textbooks:

"I am trying very hard on a boy's book on optics. Ostensibly for boys but equally for teachers, for boys thus far do not know how to learn and teachers do not know how to teach. I am so treating the subject that boys and teachers may make the experiments for themselves. My aim is to teach them both to experiment and to reason upon experiment. I suppose a boy to be alongside and that we are working together. I try to overcome the apathy and the repugnance arising from awkwardness in the first stages of experiment. I speak, therefore, not only to the boy's 'brain' but to his 'blood'—stirring him to action."

These educational ideals may to-day seem quite ordinary, but thirty years ago they were wholly new.

One of the most notable incidents in Mr. Tyndall's life was his visit to America. This took place in the winter of 1872-3. There was great difficulty in persuading him to come, as his time was always much occupied by investigations which he did not care to interrupt. At last, however, he yielded to the desire of all people of culture and scientific interest throughout the continent generally, and came. He had prepared a course of six lectures—upon heat, light, electricity, magnetism, and sound—and had prepared, also, magnificent apparatus with which to illustrate the lectures. He gave these lectures in Boston, Philadelphia, Baltimore, Washington, New York, Brooklyn, and New Haven. It is safe to say that no other European man of science—not even Huxley or Spencer—was ever more heartily received by the American public. Crowded

audiences greeted him at every appearance, even when, as once in New York, the weather was so unfit that not a soul was expected to be present. And at a public dinner given to him before he returned, almost every American eminent in science was present to wish him a happy voyage and to pay his respects to him in person. A pleasing feature of this visit, and one very honorable to Mr. Tyndall, was that the whole proceeds of the lectures were devoted by him to the encouragement of scientific study in America. The amount at first was \$13,000, but by good investment this was afterward increased to \$32,400. Accordingly, three great universities—Harvard, Columbia, and Pennsylvania—each received the sum of \$10,800 for the endowment of permanent fellowships for the benefit of students in physical science. The good that some men do lives after them.

JOHN TYNDALL

SELECTED STUDIES AND REMINISCENCES

PROFESSOR HUXLEY'S CHARACTER SKETCH OF TYNDALL

My elder by some five years, Tyndall's very marked vigorous personality must have long taken its final set when we foregathered in 1851. The dyer's hand is subdued to that it works in; and, it may be, that much occupation with types of structure, elsewhere, is responsible for a habit of classifying men to which I was, and am, given. But I found my new friend a difficult subject—*incertae sedis*, as the naturalists say; in other words, hard to get into any of my pigeon holes. Before one knew him well it seemed possible to give an exhaustive definition of him in a string of epigrammatic antitheses, such as those in which the older historians delight to sum up the character of king or leading statesman. Impulsive vehemence was associated with a singular power of self-control and a deep-seated reserve, not easily penetrated. Freehanded generosity lay side by side with much tenacity of insistence on any right, small or great; intense self-respect and a somewhat stern independence, with a sympathetic geniality of manner, especially towards children, with whom Tyndall was always a great favorite. Flights of

imaginative rhetoric, which amused (and sometimes amazed) more phlegmatic people, proceeded from a singularly clear and hard-headed reasoner, over scrupulous, if that may be, about keeping within the strictest limits of logical demonstration, and sincere to the core. A bright and even playful companion, Tyndall had little of that quick appreciation of the humorous side of things in general, and of one's self in particular, which is as oil to the waves of life, and is a chief component of the worthier kind of tact; indeed, the best reward of the utterer of a small witticism, or play upon words, in his presence, was the blank, if benevolent, perplexity with which he received it. And I suppose that the character-sketch would be incomplete, without an explanation of its peculiarities by a reference to the mixture of two sets of hereditary tendencies, the one eminently Hibernian, the other derived from the stock of the English Bible translator and reformer.

To those who have been privileged to become intimate with Tyndall, however, sketch and explanation will seem alike inadequate. These superficial characteristics disappeared from view, as the powerful faculties, and the high purposes of the mind, on the surface of which they played, revealed themselves. And to those who knew him best, the impression made by even these great qualities might well be less vivid than that left by the warmth of a tenderly affectionate nature.—PROFESSOR HUXLEY, in "*The Nineteenth Century*."

TYNDALL'S SINCERITY AND LOVE OF TRUTH

I say, once more, Tyndall was not merely theoretically, but practically, above all things sincere; the necessity of