

doing, at all hazards, that which he judged, rightly or wrongly, to be just and proper, was the dominant note of his character; and he was influenced by it in his manner of dealing with questions which might seem, to men of the world, hardly worth taking so seriously. Of the controversies in which he became involved, some of the most troublesome were undertaken on behalf of other people who, as he conceived, had been treated with injustice. The same instinct of veracity ran through all Tyndall's scientific work. That which he knew, he knew thoroughly, had turned over on all sides, and probed through and through. Whatever subject he took up, he never rested till he had attained a clear conception of all the conditions and processes involved, or had satisfied himself that it was not attainable. And in dealing with physical problems, I really think that he, in a manner, saw the atoms and molecules, and felt their pushes and pulls. A profound distrust of all long chains of deductive reasoning (outside mathematics), unless the links could be experimentally or observationally tested at no long intervals, was simply another manifestation of the same influential quality. I was not over-burdened with love for such dialectic festoon work myself, but I owe a little to my friend for helping to abolish as much as remained.—PROFESSOR HUXLEY.

#### TYNDALL IN THE ROYAL INSTITUTION

This quality of active veracity, the striving after knowledge as apart from hearsay, lay at the root of Tyndall's very remarkable powers of exposition, and of his wealth of experimental illustration. Hence, I take it, arose the

guarded precision of the substance of a lecture or essay, which was often poetically rich, sometimes even exuberant, in form. In Sir Humphry Davy and Mr. Faraday the Royal Institution had possessed two unsurpassed models of the profound, yet popular, expositor of science. Davy was before my time, but I have often had the delight of listening to Faraday. An ineradicable tendency to think of something else makes me an excellent test-object for oratory; and he was one of the few orators whom I have heard to whom I could not choose but listen. It was no mean ordeal, therefore, to which Tyndall was subjected when he was asked to give a "Friday Evening" in 1852; but he captured his hearers so completely that his appointment to the Fullerian professoriate of physics, with the use of a laboratory such as he needed for the original work he loved, soon followed. And for more than thirty years he held his own. From first to last the announcement of a "Friday Evening" by Tyndall meant a crammed theatre.—PROFESSOR HUXLEY.

#### TYNDALL AND HUXLEY AND THE "X CLUB"

In the sketch [in the "*Nineteenth Century*" for January, 1894] he has recently given of our late friend, who was one of the small group known as the "X Club," Professor Huxley has given some account of that body. Further particulars may not unfitly be added; one of which may come better from me than from him. The impression that the club exercised influence in the scientific world (not wholly without basis, I think) was naturally produced by such knowledge as there eventually arose of its composition. For it contained four presidents of the



British Association, three presidents of the Royal Society, and among its members who had not filled these highest posts, there were presidents of the College of Surgeons, the Mathematical Society, the Chemical Society, etc. Out of the nine I was the only one who was fellow of no society, and had presided over nothing. I speak in the past tense, for now [March, 1894] unhappily, the number of members is reduced to five, and of these only three are in good health. There has been no meeting for the past year, and it seems scarcely likely that there will ever be another. But the detail of most interest which Professor Huxley has not given, concerns a certain supplementary meeting which, for many years, took place after the close of our session. This lasted from October in each year to June in the next, and toward the close of June we had a gathering in the country, to which the married members brought their wives: raising the number on some occasions to fifteen. Our programme was to leave town early on Saturday afternoon, in time for a ramble or a boating excursion before dinner; to have on the Sunday a picnic in some picturesque place adjacent to our temporary quarters; and, after dinner that evening, for some to return to town, while those with less pressing engagements remained until the Monday morning. Two of our picnics were held under Burnham Beeches, one or more on St. George's Hill, Weybridge, and another in Windsor Forest. As our spirits in those days had not been subdued by years, and as we had the added pleasure of ladies' society, these gatherings were extremely enjoyable. If Tyndall did not add to the life of our party by his wit, he did by his hilarity. But my special motive for naming these rural meetings of the "X" is that I may mention a fact which, to not a few, will be

surprising and perhaps instructive. We sometimes carried with us to our picnic a volume of verse, which was duly utilized after the repast. On one occasion, while we reclined under the trees of Windsor Forest, Huxley read to us Tennyson's "Aenone," and on another occasion we listened to Tyndall's reading of Mrs. Browning's poem, "Lady Geraldine's Courtship." The vast majority of people suppose that science and poetry are antagonistic. Here is a fact which may, perhaps, cause some of them to revise their opinions.—HERBERT SPENCER, in "*McClure's Magazine*."

#### TYNDALL THE REPRESENTATIVE PHYSICIST OF HIS TIME

It was at the Royal Institution that Tyndall became really a power in the land. Endowed with a marvelous gift of clear presentation, and with a rare faculty for holding the interest of an audience, he was soon recognized above all things as the popular exponent of physical science. When one comes to ask, "What one great work did Tyndall perform in life?" it would be difficult for any man to give a definite answer. He advanced many branches of science in different directions, but, for the most part, those directions had been amply indicated beforehand by others. His observations on glaciers took up the varied threads of Agassiz, Forbes, and Faraday; his researches on heat were in the direct line of Count Rumford, and Joule, and Melloni. It is the same throughout. We cannot say of him that he gave us any one great conception, like natural selection, or the conservation of energy; any one great discovery, like spectrum analysis, or the meteoric nature of comets; any one great invention,



like the telephone or the phonograph. But his personality and his influence were persuasive and important; his powers of exposition were in every way remarkable; and his investigations, though never quite reaching the first rank in value, stood very high, indeed, in the forefront of the second. Above all, London, that great heterogeneous London, accepted him frankly as the representative physicist. Of Joule, of Thompson, of Tait, of Clerk Maxwell, of Balfour Stewart, it knew little or nothing personally; even Helmholtz was to it but a great distant name. Tyndall was there on the spot, audible and visible. He was the Royal Institution. He was also physics. This counted for much when the day of battle came, and when the forces of darkness were gathered together to crush down the forces of light in the sixties and seventies. While the orthodox physicists of the universities and of the North were willing to stand aside and let the biologists bear the whole brunt of the battle, Tyndall, who to London was the representative physicist, gave the weight of his name and his personal importance to the side of the evolutionists.—GRANT ALLEN, in "*The Review of Reviews*."

#### TYNDALL'S WORK FOR THE DOCTRINE OF EVOLUTION

Tyndall's action in this matter [the discussion *re* evolution] was no doubt largely influenced by his close personal association with Spencer and Huxley. Both those thinkers influenced him deeply. In 1856, Huxley and he went to Switzerland together, and there began those observations on glaciers which finally resulted in their joint work on the structure and motion of those moving ice-rivers. Later still, when the International Scientific Series was

projected, Tyndall popularized these investigations in his charming little book on "*Forms of Water*." Meanwhile, the evolutionary wave was gathering force and volume. Darwin had long been prosecuting his researches into the origin of species, but as yet had published nothing on the subject. Herbert Spencer, who had already proclaimed himself a thorough-going evolutionist, was at work on his great scheme of the "*Synthetic Philosophy*." Lyell was pursuing his investigations into the antiquity of man. The new ideas were in the air. At last, in 1859, the wave which had been so long advancing curled and broke visibly. Darwin, on the crest of the movement, published in that year his "*Origin of Species*." It was the greatest epoch in science since Newton advanced the theory of gravitation. Immediately the thinking world was divided into two sides. Owen and most of the physicists were in open opposition. Huxley and Hooker gave in their adhesion instantly. Lyell hesitated and wavered, but, soon convinced, accepted the new views as the necessary complement of his own uniformitarian concept of nature. At this crisis it was highly important to the evolutionists that students of biology and geology should not seem to stand alone in their acceptance of the new doctrines. Tyndall came boldly out among the physicists at the moment of need as the ally and champion of the rising movement. His aid was invaluable, and did much to help forward the triumph of that school of thought which is now for all practical purposes universally accepted. A few elder men still higgled and doubt; the younger generation, whatever science they may take up, are to a man evolutionists. Indeed, the very rapidity and certainty of the victory has made the men who gained it half outlive their fame; thou-



sands of people who now implicitly accept modern views of life, hardly know how much they owe them to Darwin, Huxley, Spencer, Tyndall.—GRANT ALLEN.

TYNDALL'S PLACE IN THE SCIENTIFIC MOVEMENT OF HIS AGE

What was Tyndall's place in the [scientific] movement of our period? Every great onward march of the human mind is like a wave on the ocean. It begins small, gathers strength and volume as it grows, and breaks at last in a conspicuous crest, visible to all men. It was so with the evolutionary movement. Erasmus Darwin sowed; Buffon, Lamarck, Robert Chambers, watered. In the fullness of time Charles Darwin, Herbert Spencer, Alfred Russell Wallace, came to crest the wave. But evolution existed before Darwin, and Darwin himself was but the man who finally made a rising cause triumph. It is the same, once more, with the other great generalization of our age, the conservation of energy. In a certain dim sense, Kepler, Newton, Laplace, saw the way that led towards it. Count Rumford had clearer glimpses of it. With Grove it began to take definite form. Joule, Helmholtz, Clerk Maxwell, Balfour Stewart, consummated it. But to no one man can the glory be given. More and more, as time goes on and co-operation increases, is this the case with science. Nobody can really say in one word who invented the steam-engine, the locomotive, photography, the telephone. People who know nothing about it will tell you glibly enough: Watt, Stephenson, Talbot or Daguerre, Bell or Edison. People who know more about it know that many separate inventors contributed many separate parts to each of these

inventions; and most of these parts could only be explained to technical readers.

Now, Tyndall was one of those men who bear a large share in the actual technical work of such great discoveries. But it is hard to put one's finger upon any single point easily to be apprehended by the ordinary intelligence. He taught us much, for example, about the way radiant heat is propagated through the atmosphere; about the objects which are, so to speak, opaque or transparent to it; about the effects it produces on the surface of our planet. He taught us much about how glaciers are formed, move, and are retarded, break into crevasses and freeze together again, compress themselves through gorges, or spread themselves, though solid, into lake-like expansions; and he did more towards explaining these singular phenomena than any other observer. His contributions to the sciences of light, of sound, of electricity, of magnetism, of heat, and even of biology (so far as regards the diffusion of the germs of minute organisms), are all of them most valuable. He was a fellow-worker in the triumph of evolutionism, and of just and sound views about energy. But for the most part he led up towards great developments in physical and electrical knowledge which have not yet been made, and towards practical inventions which have not yet been invented. This sort of work is the most valuable of all, but it is often the most inglorious. So it comes about that Tyndall, who was himself a most careful, accurate, and patient investigator, was best known as a popular expounder, and an almost sensational orator. He would not have been so famous if he had not superadded Belfast addresses and Royal Institution lectures to his real work in the laboratory and on the mountain. In these addresses, indeed, we



get the man himself at his highest development.—GRANT ALLEN.

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READERS' AND STUDENTS' NOTES

1. Biographical notices and critical estimates of Tyndall are to be found innumerable in magazines and other periodicals, but perhaps the most interesting and most complete account of Tyndall's life and work available to ordinary readers is the "Character Sketch" by Grant Allen in "The Review of Reviews" for February, 1894. Grant Allen, distinguished both for his knowledge of science and his literary style, writes of his subject—it goes without saying—appreciatively and interestingly.

2. An intimate friend and associate of Tyndall throughout almost the whole of his scientific career was Professor Huxley. When Tyndall died Huxley was importuned to write his biography. He did not write his biography, but he wrote a slight sketch in which he sought among other things, "to illustrate and emphasize the fact" that in Tyndall the world lost "a man of rare and strong individuality." This sketch is the opening number of "The Nineteenth Century" for January, 1894.

3. Herbert Spencer was also an intimate friend of Tyndall for almost as long a period as Huxley was. In fact the three great scientists were the closest of friends for over forty years together. When Tyndall died Spencer also wrote an appreciative sketch of the character and achievement of his friend as a tribute to his memory. This sketch is to be found in "McClure's Magazine" for March, 1894.

Thomas Henry Huxley