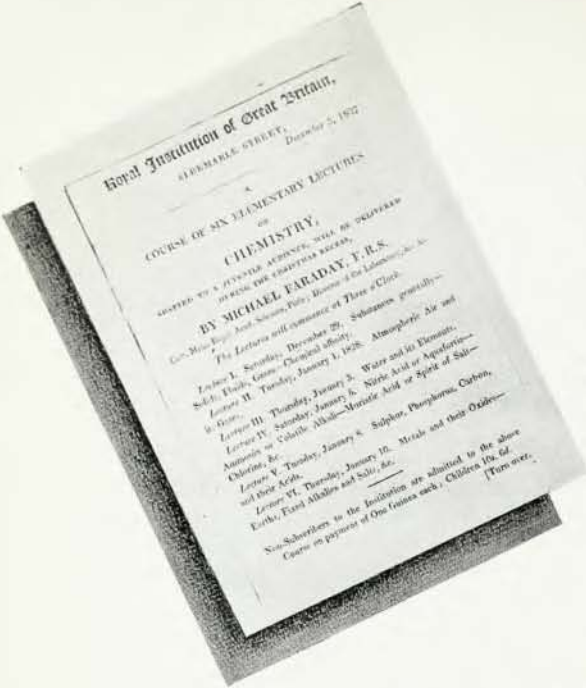




THE CHRISTMAS LECTURES AT THE ROYAL INSTITUTION

by *Thomas Martin*

The history of this series, in existence some sixscore years, is described by the General Secretary of the Royal Institution.

Every year at Christmas a course of science lectures for young people is given at the Royal Institution in Albemarle Street, London. These Christmas Juvenile Lectures are a long-established and well-known feature of the Christmas holidays, competing for popularity with the pantomimes, circuses, and other entertainments of the season. They are intended for boys and girls at school, the sons and daughters of members of the Institution and of those of the public who are fortunate enough to obtain tickets. The historic lecture theatre of the Institution is always crowded, and it is seldom that there is enough accommodation for all those who wish to come. The large and appreciative audience at the course recently given (Christmas 1947) by Professor E. K. Rideal, on "Chemical Reactions: How They Work," the one hundred and eighteenth in the series, is evidence of the fact that the lectures have lost none of their popularity.

How is it that science lectures should prove so strong an attraction at a time when, it might be thought, the children who come to them would be occupied with other things? Some of the older boys and girls are in their last years at school and perhaps going on to a university; they already know a

good deal of science, and are likely to find lectures by the distinguished men who give these courses a useful supplement to their schoolwork. There are, however, other reasons.

The scientists chosen to give the Christmas lectures are those specially gifted in the difficult art of popular scientific exposition, and the subjects are generally selected because they lend themselves to experimental illustration. It is a tradition of the lectures that they shall be fully, even lavishly illustrated by experiments. All the arts of lecture demonstration are employed and the Royal Institution is well equipped for this purpose. The lectures are, in fact, deliberately arranged each year to present to the young people who attend them some aspect of scientific work or knowledge in as interesting a light as possible; and by first stimulating their interest to give them some appreciation of the importance to them of scientific research and discovery.

The eagerness to attend the lectures is sufficient evidence of the interest they arouse; and that they succeed in their further object can hardly be doubted. It is by no means uncommon in England to hear a man of science say that he owes his first inspiration in his subject to having heard the lec-

tures by this or that great man at Christmas at the Royal Institution; and many others, not professionally engaged in scientific work, have retained vivid recollections of a similar experience.

How They Began

Many things have contributed to this result. The truth is that in the course of years a technique has been developed in the management and presentation of the lectures which has given them their reputation and made them, it is fair to say, the best of their kind. It is a matter of history and experience, and it is necessary to go back to the beginning to tell the story in full.

Except for an interval of four years, 1939-42, during the second war against Germany, when the bombing of London caused an interruption, the Christmas Juvenile Lectures have been given every

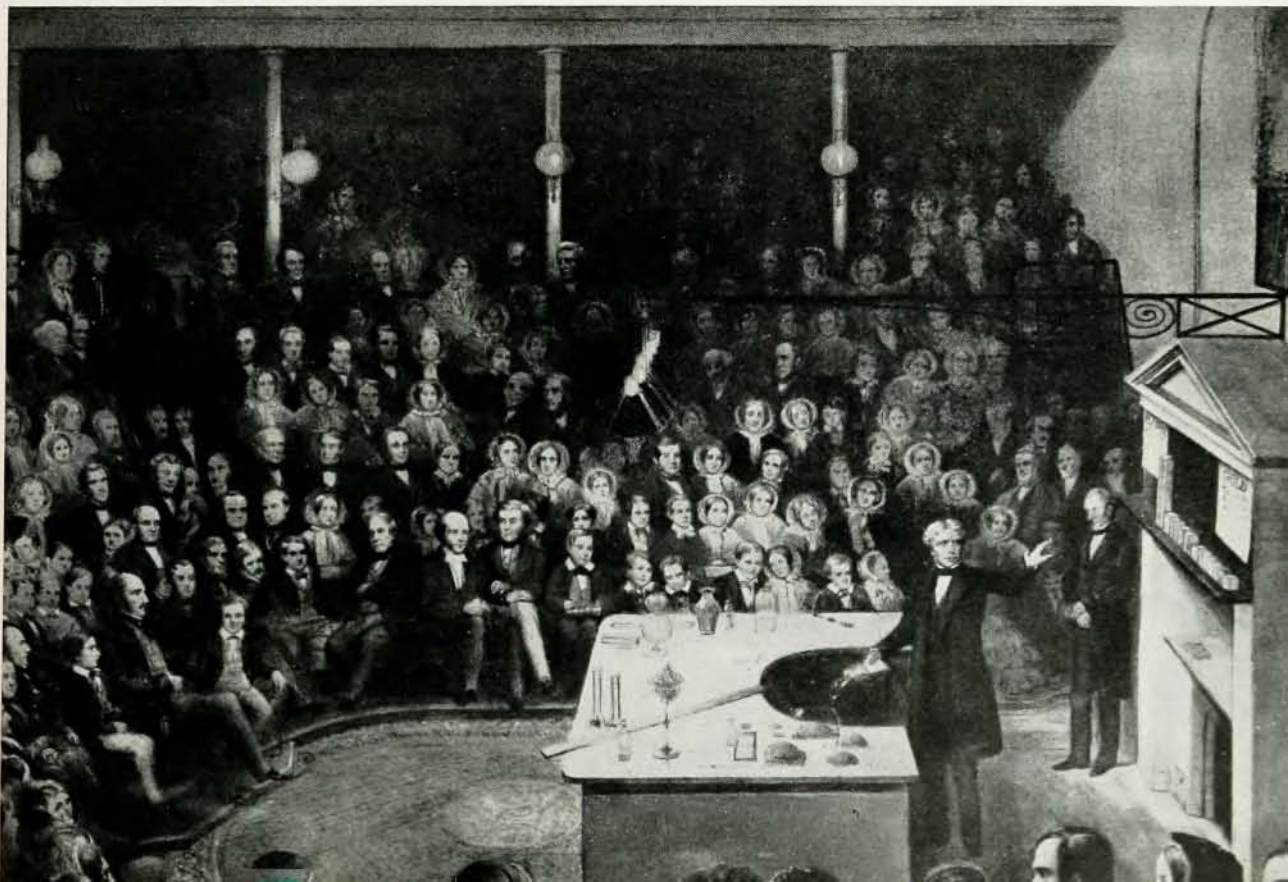
year since 1826. It has usually been considered that the series began with the course given by Mr. J. Wallis in that year, but a recent examination of the records shows that in the winter of 1825 the Managers of the Royal Institution considered and adopted a proposal to arrange a course of lectures to young people on Natural Philosophy, to be given by the Professor of Mechanics, Mr. John Millington. An advertisement in *The Times* of London of December 17, 1825, shows that Millington was to begin two days later, on December 19, a series of no less than twenty-two lectures "adapted to the comprehension of a juvenile auditory," fifteen of them before and after Christmas and the remainder in the Easter and Whitsuntide vacations.

John Millington was thus the first to give juvenile lectures in the Royal Institution, and in view of this it may be of interest to American readers to say a word as to his subsequent history. He resigned

CHRISTMAS, 1855 . . .

Faraday giving the Juvenile Lectures on "The Distinctive Properties of the Common Metals." The Prince Consort is in the Chair, with the Prince of Wales, afterwards King Edward VII, on his right and Prince Alfred on his left.

From a painting by A. Blaikley.



his Professorship in 1829, and at the age of fifty migrated to America. In 1835 he became Professor of Chemistry and Natural Philosophy at the William and Mary College, Williamsburg, Virginia, and was subsequently appointed to the Chair of Natural Science at the newly founded University of Mississippi. He died in 1868 at Richmond, Virginia, in his ninetieth year.

At the time these lectures by Millington were under discussion it was further proposed that Mr. Faraday should take part in the new enterprise; but the Managers concluded, after consulting him, that his "avocations were such that it would be exceedingly inconvenient for him to engage in such lectures." When therefore it was decided to continue the experiment at Christmas 1826, Mr. J. Wallis was appointed the lecturer, and gave a course on Astronomy, "illustrated by transparent scenery."

The Visitors of the Royal Institution, meeting in 1827, recorded their "satisfaction at finding that

the plan of juvenile courses of lectures has been resorted to." They considered that "the system of instructing the younger portion of the community is one of the most effective means which the Institution possesses for the diffusion of Science."

At the time this was said, public lectures on scientific subjects were a new departure, and experimental lectures addressed to young people of school age must have been a startling innovation. There was little or no organized teaching of science in the schools and universities, and the Royal Institution was one of the few places in England where a person who was not himself engaged in scientific work could learn something of the progress of research and hear of the latest scientific discoveries. Under the inspiration and example of its brilliant young Professor of Chemistry, Humphry Davy, the Institution had, however, during the first quarter of the nineteenth century, established a great reputation as a centre of experimental research and scien-

CHRISTMAS, 1947 . . .

Professor E. K. Rideal giving the Juvenile Lectures at the Royal Institution on "Chemical Reactions: How They Work."

Sport and General Press Agency Ltd., London



tific exposition. Davy's lectures had become popular and fashionable, and intellectual London flocked to Albemarle Street to hear him.

The Royal Institution had been founded in 1799 on the initiative of that remarkable statesman, scientist, and soldier of fortune, Benjamin Thompson, Count Rumford. An American, born in Massachusetts, Thompson had fought on the Royalist side in the War of Independence. Subsequently he had attained to high office and reputation, first in London, under the patronage of Lord George Germain, and subsequently in Bavaria, where he became Councillor of State to the Elector. His researches on heat had been largely carried out in Munich, and his administrative duties had involved him in the care of the poor and the destitute in that city. He had become much interested in the problems of practical philanthropy, to which he had applied his scientific knowledge, and his success in this field was such that when he returned to London in 1798 he found ready acceptance for an idea he had formed of a scientific institution to aid the poor by "diffusing the knowledge and facilitating the general introduction of useful mechanical inventions and improvements, and for teaching by courses of philosophical lectures and experiments the application of science to the common purposes of life."

These were the objects of the Royal Institution on its foundation, and although certain elements in Rumford's scheme, particularly those involving the direct instruction of workmen and mechanics, were found to be unpractical in London, and were dropped, the "philosophical lectures and experiments" became and have continued the main purpose of its existence. Many features of Rumford's original constitution have also been retained, among them the committees of Managers to govern and Visitors to inspect the Institution.

At the time of which we are writing, about 1826, Davy's work was nearing its end. By his remarkable experiments on the chemical action of the electric current, his invention of the miner's safety lamp, and his many other researches, he had become the leading chemist of his age. He had already been succeeded as Professor of Chemistry in the Institution by W. T. Brande, but he had continued his researches in the laboratories, assisted by the former bookbinder's apprentice, Michael Faraday, who had come to the Institution in 1813. Faraday had become a skilled experimenter under Davy's tuition and

example, and had already made important discoveries of his own; but he had also begun to show that ability in the lecture theatre for which he was afterwards celebrated.

Faraday

Both he and the Managers had evidently changed their minds when Christmas came round again in 1827, for in that year Faraday gave the Christmas lectures on Chemistry; and it is due to his methodical habits that we have fuller information on this course than we have of the earlier ones. His manuscript lecture-notes were kept and have been preserved at the Royal Institution, and pasted up in the note-book is a copy of the original prospectus.

Faraday's first course, like that of Wallis in the preceding year, was of six lectures, extending over two weeks, beginning as early as possible after Christmas, at three o'clock in the afternoon; and it is remarkable that thus early, after the trials by Millington, the Managers should have hit upon an arrangement so generally convenient. No change has since been necessary, and these times and arrangements are still observed each year for the Christmas Juvenile Lectures.

Other rules, which are indeed characteristic of all lectures at the Royal Institution, have also been observed from the beginning. As the clock strikes the hour the lecturer enters the lecture-room and begins his discourse without introduction; he speaks for exactly an hour and at the end there are neither speeches nor resolutions of thanks. Traditionally however at the Christmas lectures the young people gather round the table after the lecture, and put their questions personally or see some of the experiments over again.

The lectures of 1827 were illustrated by a large number of experiments, and Faraday's notes show that he would accompany a reference even to the simplest and most familiar phenomena, for example the vaporization of water by boiling, or burning of a taper in oxygen, by the appropriate demonstration. He was a great believer in the virtues of a simple experiment to fix a scientific fact in the minds of his hearers and the strong experimental bias of the Christmas lectures is undoubtedly due to his example. Faraday, in fact, more than any other lecturer, established the tradition of these lectures. He wrote of his first course: "These six juvenile lec-

tures were just what they ought to have been, both in matter and manner, but it would not answer to give an extended course in the same spirit." He found the short course of six lectures to be the best thing for the purpose, and later experience has confirmed his conclusion.

After the first occasion Faraday gave the Christmas lectures frequently. His second course was in 1829, on Electricity, and in this he demonstrated all the familiar phenomena of "common" and "voltaic" electricity, from the simple experiments of excitation, attraction, and repulsion to the more spectacular effects with frictional machines, Leyden jars, and voltaic batteries. The old distinctions between the various kinds of electricity were still in use, for it was before his own proof of the identity of electricities or his researches in electrostatics, electrochemistry and electromagnetism upon which much of modern electrical theory and practice are based. His great discovery of electromagnetic induction and construction of the first dynamo were not made until 1831, and it is very interesting therefore to see that, when he gave a course on Magnetism and Electricity in 1833, one lecture was devoted to "Magneto-Electricity," the notes for which are prefixed by the remark: "My own branch of science as to discovery."

Faraday had great success in lecturing to the children and derived much pleasure from this part of his work. He became a Professor in the Institution in 1833, and as his distinction as a scientist and his fame as a lecturer increased, although others shared in the duty, his lectures at Christmas became the great popular attraction. For ten years, from 1851 to 1860, he gave the course every year. Some of his courses were famous. That of 1855, on the Distinctive Properties of the Common Metals, was attended by the Prince Consort accompanied by his two sons, the Prince of Wales (afterwards King Edward VII) and Prince Alfred. That of 1848, repeated in 1860, on the Chemical History of a Candle, is even now spoken of as a model of simple, direct, and lucid exposition of scientific facts and principles. One cannot forbear quoting, for the insight it gives into the character of the lecturer, his concluding note for this course: "What wonders cluster round a candle lighted or unlighted; what strange and powerful knowledge becomes ours as we trace out and consider its powers. What instruments of good (and of evil) are thus placed in our

hands, and what an open door it offers to us into the wisdom of God in the creation. May it be ours to profit by these things and whilst we enjoy the pleasures and the marvels they present to us not to forget the power that made them."

One other quotation, before we leave Faraday. Lady Pollock wrote: "When he lectured to children he was careful to be perfectly distinct, and never allowed his ideas to outrun their intelligence. He took great delight in talking to them, and easily won their confidence. The vivacity of his manner and of his countenance, his pleasant laugh, the frankness of his whole bearing, attracted them to him. They felt as if he belonged to them; and indeed he sometimes, in his joyous enthusiasm, appeared like an inspired child."

Tyndall and Dewar

The Royal Institution has been fortunate in its professors, for many of them who have been men of the first distinction in science have also been gifted exponents of the lecturer's art. Such were two of Faraday's successors as Resident Professor in the Institution, first John Tyndall and afterwards James Dewar.

Tyndall came to the Institution in 1853, at the age of thirty-three, attracted to the position offered to him by the Managers more by the prospect of working with Faraday than anything else, and from the beginning a friendship grew up between the older and the younger man which ripened into intimacy. Tyndall had an early opportunity of experiencing what he afterwards described as Faraday's "power and sweetness" as a lecturer, for he attended the first of the Christmas lectures in 1853, and said of it afterwards: "The lecture was a delight to hear. I learned hardly anything in the way of science, but in the way of handling science, so as to render it profitable to others, I learned much." Seven years later Faraday wrote to the Managers expressing his regret that advancing years compelled him to lay down the duty of giving the arduous Christmas course, from which he had derived so much pleasure; but his regret was tempered by the thought that his young colleague and friend would succeed him.

With his researches on diamagnetism and on the radiation and absorption of heat, his growing reputation as a popular lecturer and writer, his moun-

taineering and investigations of the Swiss glaciers, and not least his Irish temperament and love of controversy, Tyndall soon became a well-known figure. His fluency and animation at the lecture table and his skill in devising experiments made him an admirable lecturer to the children, and from 1861 onwards he gave the Christmas course every other year for many years, lecturing on heat, light, and a variety of other physical subjects. He alternated with Frankland, Dewar, and others who lectured on chemistry.

Sir James Dewar's researches on the liquefaction of gases and the properties of substances at low temperatures lent themselves admirably to lecture demonstration. He gave the Christmas course at intervals from 1878 to 1912, and would take endless pains in arranging the demonstrations and rehearsing his lectures. Many still remember his spectacular experiments with liquid air, his use of the vacuum or thermos flask, which he invented for conserving the liquid gases, and his application of the absorptive power of charcoal for gases at low temperatures in exhausting his glass vessels. On other occasions he showed many beautiful experiments with soap bubbles and thin films.

Recent Years

As the years went by the choice of subjects for the Christmas lectures widened. Astronomy and astrophysics have proved popular subjects in the hands of such accomplished lecturers as Sir Robert Ball, Professor H. H. Turner, Sir James Jeans, and the present Astronomer Royal, Sir Harold Spencer Jones. It will be recalled that Wallis used transparencies to illustrate his course on astronomy as far back as 1826; and astronomy as a subject has been much assisted in more recent years by the modern developments in photography and optical projection.

Biology has also made its contribution, with courses such as those of Sir Ray Lankester on Extinct Animals, Sir D'Arcy Thompson on the Fishes of the Sea, and Professor Balfour Browne on the Habits of Insects; but biological subjects are at some disadvantage for the Christmas lectures in that they do not give opportunities for experiment comparable with those of the physical sciences.

Professor Rideal last Christmas and Professor James Kendall in 1938 on Young Chemists and

Great Discoveries, have shown that chemistry, with its endless possibilities of experiment, retains its hold on the youthful imagination; but a characteristic of recent years has been the many admirable courses on physical subjects. Sir William Bragg on Old Trades and New Knowledge, and on the Universe of Light, Professor E. N. da C. Andrade on Vibrations and Waves, and Sir Robert Watson Watt on Wireless have all in their turn given great delight to their young hearers. Bragg with his infectious enthusiasm, his love of a simple experiment to demonstrate a physical principle, and his obvious pleasure at its success, had the authentic touch of his great predecessor Faraday in his approach to the children. One remembers him, for example, in describing Dewar's discoveries, arousing excitement and laughter among his audience by cooling a rubber ball in liquid air and then breaking the brittle sphere to pieces by flinging it against the wall behind him.

Faraday depended on experiments on the lecture table and diagrams hung on the walls to illustrate his lectures. The use of lantern slides came later with the development of the electric arc as the illuminant for the lantern, and the invention of photography. Tyndall was probably the first Christmas lecturer to use these aids extensively. Later lecturers on such subjects as colour or polarization have had the advantage of the modern methods of optical projection, and many beautiful experiments can now be shown to audiences which could formerly be seen only by single observers. The simple device of projecting an enlarged image of an instrument dial, or a moving column of liquid in a tube, adds to the interest of a physical experiment, while the resources of the lecturer have been extended by the inventions of micro-projection, the epidiascope, and the cinematograph projector. The contribution which photography has made to the arts of exposition was itself admirably illustrated in the Christmas course on Photography given by Dr. Kenneth Mees of the Kodak Laboratories in 1935.

Not all of those who attend the Christmas lectures are juveniles, for it is the custom of parents and even of grandparents to sit in the gallery and look down on the rows of young people facing the lecturer in the seats reserved for them below; and no one who has had that experience will doubt that the Royal Institution is performing one of its most valuable services to science in giving its annual course "adapted to a juvenile auditory."