here Woodward's ancient cabinets are piously preserved. Adjacent to them are the rooms of the Woodwardian professor, Prof. Hughes, and a board room.

On the second floor are numerous students' class rooms and private rooms for the various demonstrators and teachers. On this floor also is a library the beautiful fittings of which were provided from a gift of money presented to the university by the late Master of Trinity Hall.

Between the two arcades, which lead from one wing of the Museum to the other, stands the bronze statue of Adam Sedgwick which was unveiled by the King on Tuesday. This statue was one of the last works of Mr. Onslow Ford, and represents the professor with a geological hammer in one hand and a specimen in the other. Considering that this statue was made more than thirty years after the death of him whom it commemorates it is wonderfully successful.

The Law School forms the central block on the north side of the new courtyard. It is, in fact, the centre of Mr. T. G. Jackson's façade. The university has been able to erect this noble building by the generous bequest of Miss Rebecca Flower Squire, who has also endowed certain scholarships to be held by law students in the university. To the 15,000*l.* which the trustees allotted for the purposes of the Law Library the university has been able to add sufficient to complete the Law School by the addition of professors' rooms, lecture rooms, and examination rooms. The main library is a lofty room 85 feet by 30 feet in area, lighted by spacious windows on the north and south, and with book-cases projecting towards the centre of the room between each window. Above these are ample space for storing duplicates and books which are seldom used. Each end of the room is provided with a handsome gallery.

For some time, owing to the wants of the university library, the professor of civil law has been driven out of the old Law School and has been a wanderer through the literary lecture rooms. Miss Squire's bequest has enabled the university to find him a home, and for the first time in the history of the Cambridge Law School, more than five or six hundred years, the students of law will assemble in a handsome and roomy building especially adapted for their very needs and in close contiguity to the ample library.

The illustrations which accompany this article are taken from photographs made by Mr. Palmer Clarke, of Cambridge.

EDUCATION AND PROGRESS IN JAPAN.

IN his address at Southport last September, the president of the British Association, taking as his subject "The Influence of Brain-power on History," traced convincingly and conclusively the intimate relation that exists between the provision made by a nation for the higher education of its people and the position taken by that nation in the ceaseless competition between the great countries of the world. After a searching comparison between the facilities for university education in this country on one hand and in the United States and in Germany on the other, Sir Norman Lockyer said:—"But even more wonderful than these examples is the 'intellectual effort' made by Japan, not after a war, but to prepare for one. The question is, Shall we wait for a disaster and then imitate Prussia and France; or shall we follow Japan and thoroughly prepare by 'intellectual effort' for the industrial struggle which lies before us?" It would indeed be difficult to find a more striking example of the profound and comparatively immediate effect on national prospects which an earnest and thorough attempt to establish a complete system of education can effect. The events of the past few weeks serve to bring into high relief what was before clear enough to students of educational progress, that Japan has succeeded in a little more than thirty years in bringing about a revolution without bloodshed, in changing an eastern people—among whom originality was considered a form of disloyalty—into a powerful nation equipped with western education and possessed of all the resources of modern civilisation.

In the following attempt to trace the leading events of these thirty years of Japanese progress in education, reference has been made to numerous authorities, but most of the facts included are from a statement of the development and present position of State education in Japan prepared by Mr. Robert E. Lewis, of Shanghai, and published in the reports of the United States Commissioner of Education.

The beginning of modern Japanese history dates from 1868. For three and a half centuries before this date, to quote Mr. Lewis, "Confucius was the headmaster of Japan, with Buddhist priests as his understudies." But with the coming of the new learning and with the arrival of English-speaking people from America in 1853 and from England—in the persons of Lord Elgin and his suite—in 1858, in which year the British-Japanese treaty was signed, a change commenced which was destined, as subsequent events have shown, to be a rapid one.

A provisional board of education was established in Kioto in 1868, and three years later the Mombu-sho, or department of education, was established with a Minister of State to preside over it. The first educational code was issued in 1872, and in promulgating it the Emperor said:—"All knowledge, from that necessary to prepare officers, farmers, mechanics, artisans, physicians, &c., for their respective vocations, is acquired by learning. It is intended that henceforth education shall be so diffused that there may not be a village with an ignorant family or a family with an ignorant member." In 1898, that is, in twenty-six years, out of 7,925,966 children of school age in the country, 4,062,418 were being educated in schools modelled on western plans. Moreover, if only the boys are taken into account, there were in that year 82·42 per cent. of the Japanese boys of school age receiving what may be described as education in the European sense.

In 1872 what was known as "the world's embassy," consisting of forty-nine representative Japanese, including Prince Iwakura and Marquis Ito, was at work, and much of its attention was devoted to observations of education in Europe and America. The plan of sending Japanese students to foreign countries for the purpose of studying modern thought and methods has been much employed by the educational authorities of Japan, though in recent years the custom has been largely discontinued, as highly educated Japanese have become available for university and similar posts. For instance, in 1873 there were 250 students studying in foreign countries at the expense of the Japanese Government, while in 1895 only eleven Japanese students were similarly officially sent abroad. The same tendency to dispense with foreign assistance at the first opportunity is noticeable also when the personnel of the staffs of the institutions in connection with the Japanese department of education is examined. Though in the years following the promulgation of the first education code by the Japanese Government the number of European and American professors and instructors was relatively

very large, by 1896 the total number of such foreign teachers in State institutions had fallen to thirty-one, of whom ten were from Great Britain and eleven from the United States. If, however, in addition to State institutions all other public and private educational establishments are included, it is found that the number of foreign instructors is much higher. Thus in 1895, 167 men and 101 women from Europe and America were engaged in teaching in Japan.

A complete understanding of the success of Japan's provision of university and technical education can only be arrived at by first considering the steps which have been taken in the direction of securing a satisfactory system of primary and secondary education. Japan seems to have learnt completely what is now only beginning to be understood in this country, that for complete success a system of higher education must be firmly based upon an adequate and properly coordinated supply of institutions in which a sound preliminary education is given. This seems to have been the idea in the mind of President Ibuka, who, speaking in America, said that when Japan reached out after western ideas she copied her navy from Great Britain and her educational system from America. It is therefore desirable to refer briefly to the conditions of elementary and secondary education in Japan.

The elementary schools of Japan are of two grades, ordinary and higher. It will be sufficient in this connection to refer to them as public elementary schools. In 1898 there were 26,322 of these schools, with an annual cost for maintenance of 1,715,470*l*., to which sum the Japanese taxpayer contributed 1,150,446*l*. Nearly five thousand of these elementary schools provide special supplementary courses of a more advanced character, in which preliminary instruction is provided for boys, in the branches of science underlying agricultural practice and rural economy, and those on which the needs of industry depend, while for girls the special requirements of the household are taken into account, and instruction is given in such subjects as sewing and needlework. It is interesting to notice that a decree of the Japanese Government dating from August, 1900, made the education in all public elementary schools to all intents and purposes free.

As indicating the attitude of the Japanese people towards education, it should be stated that their voluntary contributions towards its support are on a generous scale. In 1896 voluntary gifts to the public school fund amounted to almost 154,000*l*., in addition to which during a single year the people contributed for educational purposes 3,677,000 acres of land, 14,000 books, and nearly 16,000 pieces of apparatus. As Mr. Lewis has remarked, "it may be said roughly that in support of popular education in Japan the gifts of the people in money are more than one-fifth the amount realised from fees, and that the latter are about one-third as much as the amount of the local taxes for education." Before leaving the subject of elementary education, it is significant to remark that in 1896, while the percentage of the population of Great Britain under instruction in elementary schools was fifteen, Japan, with its short experience in educational matters, had managed to bring the percentage up to ten.

Intermediate between the public elementary school and the university, two classes of schools are to be found in Japan, the common middle schools and the high schools. As in some European countries, these schools are made more attractive to the Japanese people because attendance at them exempts from a certain amount of military service. Thus a common middle school course exempts from two or three years of military service, and attendance throughout a high school course excuses the student from conscription until twenty-eight years of age, when a single year as a volunteer with the colours exempts from further military service. The educational authorities of Japan have, too, learnt the importance of carefully coordinating one grade of school with those immediately below and above it. To give an instance, a pupil who has successfully completed the course of a common middle school can claim admittance to a high school without examination, and one who has obtained a certificate showing that he has attended the complete course of a high school may at once enter the university without a matriculation examination, and he is, moreover, considered to be fully qualified for any public post.

In 1898 there were in Japan 169 common middle schools, and in 1896 six high schools. In the former there were 2061 teachers and 49,684 students, and in the latter 290 teachers, of whom only twelve were foreigners, and 4231 students. Of the total number of students who completed the courses of the common middle schools, three-fifths entered high schools, one-eleventh entered the army, and one twenty-eighth became teachers. Of the high school students, 55 were in law courses, 127 in engineering, 1469 in medicine, and 2580 in general courses leading to the university.

It appears, says Mr. Lewis, that the subject most insisted on in the common middle schools is the English language; that the Japanese language and Chinese literature, studied as related themes, are second; gymnastics receives more attention than mathematics or history, and far more than ethics. The explanation of the anomaly is in the fact that by the training of the body Japan hopes to repair the physical defects of the people. The same authority states that the courses of study are not uniform in the Government high schools; in five of them the greatest emphasis is laid on the general preparatory courses for the university. One of them has departments of law and engineering, and its advanced courses constitute the beginning of Kioto University.

Though the foundation for technical education is laid in the elementary, middle and high schools of Japan, we may fairly say that the higher education of the country is given in its universities and technical institutions. It will be convenient to deal with the universities first.

There are two universities, one in Tokyo and the other in Kioto. The former is the more important, and it will suffice to indicate the nature of its work, constitution, and cost. The Imperial Tokyo University was organised in 1877, remodelled in 1886, and enlarged to include a college of agriculture in 1890. For the first ten years or so after its organisation the university followed the American plan, but since then it has been more inspired by German ideals. The university at present consists of a university hall—devoted to the purposes of post-graduate study including original scientific research—colleges for the study of law, science, engineering, medicine, agriculture and literature, library, botanical garden, astronomical observatory, marine laboratory, and two hospitals.

In 1898 there were 205 professors and 2465 students in the university. Though the distribution of these professors is not available for 1898, the 161 professors attached to the university in 1895 were divided among the six colleges as follows:—law, 22; medicine, 30; engineering, 35; literature, 25; science, 18; and agriculture, 31. The number of students has increased steadily year by year, as the following table shows:—

Number of Students in the Imperial Tokyo University.

College, &c.	1885	1890	1895	1896	1897
University Hall...	0	47	105	146	174
Law	217	301	472	551	737
Science	43	77	102	105	105
Engineering ...	30	106	295	345	385
Medicine	726	188	178	223	297
Literature ...	129	88	219	248	278
Agriculture ...	0	485	249	215	232
Total	1145	1292	1620	1833	2208

In 1898, 30 per cent. of the total number of students were studying law, 9 per cent. medicine, 31 per cent. engineering, 7 per cent. science, and 4 per cent. agriculture.

Mr. Lewis provides interesting particulars of the subsequent careers of the graduates from Tokyo University for the year 1896. Of 308 graduates that year 107 were given administrative or judicial positions by the Japanese Government, 48 were admitted to University Hall there to engage in original research, 45 obtained posts in banking houses and similar important commercial undertakings, 44 remained unoccupied, 42 became instructors in the universities and high schools, 15 remained in the colleges for post-graduate work, and 7 took up various other callings.

As regards the annual expenditure on Tokyo University, the following table shows the amounts spent on the different constituent colleges in the year 1895 :—

Imperial Tokyo University Expenditure for the Year 1895.

	£
University Hall	11,000
College of Law	9,500
College of Science	14,000
College of Engineering	15,000
College of Medicine	52,000
College of Literature	11,000
College of Agriculture	15,500
Total	128,000

Now it must be remembered that the Government department of education is responsible for the maintenance of higher education in Japan, and it is at once seen that in Japan the State found for the Tokyo University in 1895, apart from the University of Kioto, about 130,000*l*. The present State contribution to the whole of our universities and colleges together amounts only to 155,600*l*., and in favoured Germany the State endowment of the University of Berlin in 1891–2 amounted to 168,780*l*., so that with educational traditions dating back only thirty-five years Japan is well on the way to an equal State expenditure on higher education.

The students of the Tokyo University are drawn, says Mr. Lewis, from all classes of society as in America. "There seems to be no special class of men who were predestinated for the university. . . . If the past thirty years might be taken as a basis, one may look forward to the time in Japan when, as in Scotland, the universities may claim one from every thousand of the population; or when, as in Scotland, one man out of each five hundred will have a *bona fide* university degree."

Besides the institutions of higher education which have now been described, there are in Japan, according to the Japanese Government report for 1896, sixty technical schools of various kinds. Thirty-seven of these are devoted to instruction in agriculture, seven to branches of industry, and sixteen to commerce. These sixty schools employ 424 teachers, and are attended by 7600 students. Among the more important of these schools the Tokyo Technical School takes a high place. It gives instruction in electrical mechanics, electrochemistry, dyeing, weaving, and many other branches of technology. The primary object of the school is to train manufacturing experts, and the school has already gained a high reputation for the amount of its original work for the improvement of manufacturing processes. Japan also has sixteen apprentice schools with 1875 students.

Merely to state the number of technical schools in the country is to fail to give a true idea of the Japanese system of technical education, because in both the elementary and secondary schools some attention is devoted to instruction of a technical kind. Though many authorities in this country, in Germany, and in America would disapprove of this approach to early specialisation, it seems probable that the great success of institutions like the Tokyo Technical School may be due to the fact that the early introduction of Japanese boys to technical studies makes it possible to weed out those unlikely to benefit by the advanced courses of the technical schools, and to concentrate attention on those who possess natural aptitudes for such work.

Such is a brief outline of the change which has taken place in Japan since 1868, when its first provisional board of education was formed. If with all the disadvantages under which she laboured Japan has been able by persistent effort and by continuous sacrifice in the way of State endowment and private munificence to effect an educational revolution, it requires little enough faith to believe that if as a nation we set to work to put our educational house in order—to endow adequately our present universities, to establish others where they are required, to level up our secondary education—there would be no need pessimistically to contemplate the future of the Empire, and to imagine for it a possible third or fourth place in the world struggle for supremacy. A. T. SIMMONS.

THE EVOLUTION OF MATTER AS REVEALED BY THE RADIO-ACTIVE ELEMENTS.

ON Tuesday, February 23, Mr. F. Soddy delivered the Wilde lecture before the Manchester Literary and Philosophical Society. The lecture, it may be explained, is delivered annually, and is provided for out of an endowment by Dr. Henry Wilde, F.R.S.

After referring to the three-fold character of the rays emitted by radium, Mr. Soddy explained that the α-rays contained more than 99 per cent. of the whole energy given off, and were of paramount importance on other grounds, as opening up a new field of research with which the ordinary methods of chemical analysis had no connection. The mass of the particles composing the α rays was about equal to that of an atom of hydrogen; they carried a positive charge, and were deviable, though to a very minute extent, in a powerful magnetic field. Their velocity was about 20,000 miles a second, and they were easily stopped, even by a thin sheet of paper, or a few centimetres of air. All three kinds were detected by their power of exciting fluorescence in certain substances, and by their action on a photographic plate, but their distinctive property was that of ionising the air and other gases through which they pass. Had it not been that their energy effects are out of all proportion to the masses of the bodies concerned, the radio-active property would have remained undetected. Thus uranium and thorium have been known for several generations, yet it is no longer ago than 1896 that Becquerel began the researches which have since proved so fruitful in the hands of M. and Mdme. Curie, Prof. Rutherford, Sir W. Ramsay and others.

As regards the radio-active elements themselves, they are regarded as undergoing a slow spontaneous