

Two interesting points appeared in this experiment. In the first place, the ratio between the two quantities of kathode rays, which appear on the two sides of a silver leaf through which the "tin rays" pass, is nearly constant for different thicknesses of leaf. With the thinnest leaf obtainable each quantity was about half its full value. It would have been desirable to have had still thinner leaves; but it is fairly clear that the ratio would be nearly the same for extreme thinness. The kathode radiation, which appears on the side of the leaf whence the X-rays emerge, is 1.30 times that which appears on the other, and we may take it that this would be the case even if the leaf were but one atom thick. Thus when an X-ray plunges into an atom in which its energy is converted into that of a kathode ray, the kathode ray may emerge at any point, but there is a 30 per cent. greater chance that it will more or less continue the line of motion of the X-ray than that it will not. In previous work on the conversion of γ -ray into β -ray energy, I have found that the β ray may practically be supposed to continue the line of motion of the γ ray, so that there is a great difference in behaviour of the two classes of ray in this respect. It is remarkable that the scattering of the γ rays shows also a much greater dissymmetry than is found in the case of the X-rays. It looks as if the β rays that appear when γ or X-rays impinge on atoms are related rather to the scattered than to the unscattered primary rays. Putting it somewhat crudely, no doubt, it might be said that when a γ or X-ray is deflected in passing through an atom, it runs a risk of being converted into a β ray in the process, so that β rays are found distributed about the atom in rough proportions to the secondary γ or X-rays. In the case of γ rays this practically amounts to their all going straight on at first; in the case of X-rays the distribution is more uniform.

Another interesting point arises in this way. When the X-rays from tin are allowed to pass into the ionisation chamber through increasing thicknesses of silver foil, the kathode rays grow at a rate which is not represented by the exponential curve usually assumed. The amount is for some time more nearly proportional to the thickness of the foil. A second foil adds its own effect without destroying much of the one on which it is laid. This may easily be ascribed to the relation of the ionisation due to the β particle to the energy it has to spend. The ionisation is nearly all at the end of the path, and the second layer does not absorb the rays made in the first because they are still at the beginning of their career.

These few experiments which I have described may serve to illustrate both the justice and the convenience of placing all these rays, α , β , γ , and X, in one class. We are tempted to consider them all as corpuscular radiations of some sort, and we then look upon our researches into their behaviour as attempts to understand the collisions of the various new corpuscles with the constituent centres of force in the atoms. But if we ascribe corpuscular properties to the γ and X-rays, we are led far away from the original speculations as to their nature. Stokes supposed them to be spreading æther pulses, but in his theory the energy of the pulse spreads on ever-widening surfaces as the time passes, and is utterly insufficient to provide the energy of the β rays which the γ or X-rays excite. Some sort of mechanism has to be devised by which the energy of the γ ray moves on without spreading, so that at the fateful moment it may be all handed over to the β ray, which carries it on. I had the hardihood myself to propose a theory of this kind. My idea was that the γ or X-ray might be considered as an electron which had assumed a cloak of darkness in the form of sufficient positive electricity to neutralise its charge. Nor do I see any reason for abandoning this idea, for it is at least a good working hypothesis. It means, of course, that not only does the energy of the β ray come from the γ ray, but the β ray itself.

Many insist that my neutral corpuscle is too material, and that something more ethereal is wanted, for it appears that ultra-violet light possesses many of the properties of X and γ rays. It can excite electrons to motion, and sometimes the speed of the electron depends on the quality of the light, and not on the nature of the material from which it springs. They propose, therefore, a quasi-corpuscular theory of light, γ and X-rays being

included. The immediate objection to this proposal is that it seems to throw away at once all the marvellous explanations of interference and diffraction which Young and Fresnel founded on a theory of spreading waves, and I do not think anyone has yet made good this defect. The light corpuscle which is proposed is a perfectly new postulate. It is to move with the velocity of light, keeping a circumscribed and invariable form, to have energy and momentum, and to be capable of replacing and being replaced by an electron which possesses the same energy but moves at a slower rate, and, of course, it has to do all that the old light-waves did. The whole situation is most remarkable and puzzling. We are working and waiting for some solution which, perhaps, will come in a moment unexpectedly. Meanwhile, we must just try to verify and extend our facts, and be content to piece together parts of the puzzle, since we cannot, as yet, manage the whole. My object to-night has been to show you how we may conveniently bind together a large number of the phenomena of radio-activity into an easily grasped bundle, using a kinetic theory which has many points of resemblance to the older kinetic theory of gases.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—It is proposed to confer the degree of Master of Arts, *honoris causa*, upon Mr. K. J. J. Mackenzie, university lecturer in agriculture.

On Thursday next, February 16, a Grace will be offered to the Senate recommending that a site on the Downing Ground be assigned for a building for the department of physiology, to the east of the School of Agriculture. At the same Congregation a further Grace will also be brought forward recommending that a space to the south of, and adjoining, the proposed building for the department of physiology, be assigned as a site for a laboratory of experimental psychology.

OXFORD.—On February 4 Prof. T. W. Edgeworth David, C.M.G., F.R.S., delivered a public lecture before the University, in which he described the part he had taken in Sir Ernest Shackleton's Antarctic Expedition of 1907-9, including the ascent of Mount Erebus and the reaching of the South Magnetic Pole. On February 7 the honorary degree of D.Sc. was conferred on Prof. David.

The report of the committee for anthropology for the year 1910, just presented to Convocation, contains a record of continuous and healthy development of the study in Oxford. The salary of the curator of the Pitt-Rivers Museum has been raised from 200*l.* to 500*l.* per annum, and a readership has been founded in social anthropology, to which the secretary to the committee, Mr. R. R. Marett, Fellow of Exeter College, has been appointed. A large number of lectures have been delivered in the course of the year under the general heads of physical anthropology, psychology, geographical distribution, prehistoric archaeology, technology, social anthropology, and philology, besides special lectures for Sudan probationers, and addresses on the art of prehistoric man in France, by M. Emile Cartailhac.

The consideration of the proposed amendments to the statute on faculties and boards of faculties has been resumed by Congregation.

It is announced in the *Revue scientifique* that Prof. Hans Meyer has presented 150,000 marks to the University of Leipzig for the inauguration of an institute of experimental psychology.

We have received from the honorary secretary of the Association of Teachers in Technical Institutions a copy of a letter sent by the association to the principal of the University of London directing attention "to the marked inequality of the requirements of the examiners for a 'pass' in the respective subjects" for the intermediate and final B.Sc. external examinations. Tabulated statistics, drawn up by the association from the University Calendar, show that in 1909 the following percentages of candidates, entering for the various subjects of science in the intermediate external examination, failed:—chemistry, 46.9; physics, 30.7; pure mathematics, 25.3; applied

mathematics, 14.4; botany, 47.8; zoology, 28.8; and geology, 14.3. The corresponding numbers in the B.Sc. examination of 1909 were:—chemistry, 58.5; physics, 30.5; pure mathematics, 35.4; applied mathematics, 42.1; botany, 33.3; zoology, 14.3; and geology, 14.3. The principal is asked to bring these and other points for consideration before the Senate and Council for External Students, since, in the opinion of the association, a serious injustice is being done to students and teachers.

We learn from *Science* that the bequests from the Kennedy estate for educational and public purposes are even larger than had been anticipated. Columbia University receives 472,000l., New York University 190,400l., and Robert College, Constantinople, 360,000l.; the bequests to the New York Public Library and the Metropolitan Museum of Art are about 560,000l. Barnard College and Teachers College, Columbia University, each receive 20,000l., as do Hamilton College, Elmira College, Amherst College, Williams College, Bowdoin College, Yale University, Tuskegee Institute, and the Hampton Institute, Lafayette College, Oberlin College, Wellesley College, Berea College, and Anatolia (Turkey) each receive 10,000l. *Science* also states that Mr. Carnegie's latest gift of 760,000l. to the Technical Institute in Pittsburgh is to be used approximately as follows:—460,000l. for increase of present endowment, 275,000l. for new buildings, 20,000l. for additional equipment, and 5000l. on grounds. The residue of the estate of the late Dr. Seesel, valued formally at "not more than 50,000 dollars," is divided between Yale and the University of Leipzig. With the income there is to be founded at each institution the "Theresa Seesel Fund" in memory of his mother, to be used for researches in biology.

The first volume of the report for the year ended June 30, 1910, of the U.S. Commissioner of Education has been received from the Bureau of Education at Washington. As usual, the publication of purely statistical information is postponed for the later volume. The commissioner, Dr. Elmer Brown, in his introduction to the volume ably summarises the tendencies and advances in the various grades of education which may be regarded as the outstanding features of the educational work of the year under review. The part of the introduction dealing with higher education is of special importance. Dr. Brown points out that by its higher education the place of the United States in the world's civilisation and its prestige before the more enlightened nations are largely determined. "It is," he says, addressing his countrymen, "a patriotic duty of the highest order that our colleges and universities, in all of the States, should get away from the more injurious forms of competition and enter into more effective cooperation." He enumerates many weaknesses requiring correction. He urges that an agreement among the colleges with respect to admission requirements, which should do away with minor differences that harass the preparatory schools, would rid the educational situation of some of its most serious embarrassments. There is, he continues, a great deal of possible division of labour, particularly as regards instruction and research, which is not yet realised. Much has yet to be done in the way of a general survey of the present provision in American institutions of higher education for advanced instruction with the view of determining where enlargement is needed. The excessive variations in the worth of American academic and professional degrees is still, says Dr. Brown, a cause of reproach abroad, and involves much injustice among Americans at home.

A NATIONAL conference will be opened at the Guildhall on February 28, at 3.30 p.m., by the Lord Mayor, with the object of securing a national system of industrial training. The conference has been organised by a special committee of the elected representatives of the chief associations of employers and workers and educational authorities. The intention is to urge upon the Government to supplement our present system of elementary education by providing by legislation a complete system of industrial, professional, and commercial training. Several resolutions will be submitted at the conference, among which may be mentioned the following:—"That this conference views with grave concern the large number of children annually

leaving school without practical training for definite vocations, and resolves that a national system of industrial, professional, and commercial training should be established, to which the children shall pass as a matter of course (unless the parents are prepared to undertake their future training) and without interval, for a definite period, to be thoroughly trained for entry to the particular calling for which they are best fitted, such training to be under fully qualified instructors. That the Government be urged to provide by legislation such a complete system of training, free to all scholars, and the expenses thereof defrayed from the National Exchequer." The National Industrial Education League, which it is proposed to establish at the meeting, will be composed of 2500 organised bodies of workpeople engaged in trade union, cooperative, and educational work, and, so far as can be at present ascertained, they represent more than three millions of workers, comprising 365 trades and professions in 421 cities and towns. Intending supporters of the league can obtain further information on application to the honorary secretaries, Craig's Court House, Charing Cross, London, S.W.

At the meeting of the Royal Society of Arts on February 1, presided over by Lord Cromer, Mr. P. J. Hartog read a paper on examinations in their bearing on national efficiency. He raised the important question as to whether it was not possible to test "general ability," and to separate the ablest candidates by methods involving less strain both on the successful and the unsuccessful candidates? Would it be possible, without reintroducing the evils of jobbery, to follow the lines laid down by Lord Cromer in the Egyptian Civil Service, and by Lord Selborne in choosing candidates for the Navy? He suggested the appointment of a Royal Commission to deal with the whole question, with a suitable reference, such as "To investigate and report upon the methods and efficiency for their purpose of examinations carried on by Government departments and other public bodies in the United Kingdom; to inquire into the influences of examinations on the previous education of candidates; and to suggest such changes as may seem desirable." The commission, he said, should be a small one, presided over by a statesman with experience of affairs, and there should be no attempt to achieve the impossible by including in it representatives of all parties concerned. Lord Cromer opened the discussion which followed. He compared the merits of competition and selection for securing the best candidates for any office. The principle of selection, he maintained, if only it can be properly carried out, possesses merits superior to those of competition. The former may or ought to result in the creation of leaders of men. The latter tends rather to produce a dull level of mediocrity. Of late years there has been a tendency, notably in the military, naval, and diplomatic services, to adopt the principle of selection in dealing with all the later stages of the careers of public servants more thoroughly than formerly. This movement, far from being arrested, should be pushed still further. The case of first appointments presents, naturally, greater difficulties. Some few years ago it became necessary to create a Sudanese Civil Service. In the first instance, the appointments were practically made by Lord Cromer. He found it, he said, a difficult task, but whatever success has attended the administration of Egypt during the last thirty years has been mainly due to the care which was taken in selecting and promoting officials.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, February 2.—Sir Archibald Geikie, K.C.B., president, in the chair.—Colonel Sir D. Bruce, F.R.S., Captains A. E. Hamerton and H. R. Bateman, and Dr. R. Van Someren: Experiments to investigate the infectivity of *Glossina palpalis* fed on sleeping-sickness patients under treatment.—Colonel Sir D. Bruce, F.R.S., and Captains A. E. Hamerton, H. R. Bateman, and F. P. Mackie: Experiments to ascertain if *Trypanosoma gambiense* during its development within *Glossina palpalis* is infective.—Captain R. McCarrison: Further experi-