tion and the intrinsic value are the same. With regard to the English didactic method, we have been struck by a greater tendency towards a systematic arrangement and simplification of methods; one receives the impression that the whole system of English education is based much more on visual representations than is the case with Italian methods, which are more verbal and abstract. This is particularly apparent and important in connection with primary and secondary instruction, which makes an excellent impression, both on account of the intuitive basis of the education and the distribution of subjects and time, as well as on account of the large part which is devoted to moral and physical training. In her conception of what elementary and secondary schools should be, both intrinsically and extrinsically (methods of teaching and scholastic buildings), England offers a notable example, which is worthy of study, especially by us Italians, for whom these problems are of the greatest importance, as the Government and the people are fully aware.

With regard to the universities, on the other hand, we were able to pursue our journey in company with English men of science, trusting to those spiritual affinities which have hitherto been of such great value in strengthening the friendship between our two peoples. Our visit to certain universities which were more particularly technical gave us great satisfaction for a different reason, since they showed us that they were well on the way towards that co-operation between the man of science and the industrialist which, with ourselves, has recently proved to be very effective. It is in virtue of a similar co-operation that the Italian universities have now, in some branches of education, an abundance of means which ensures their proper working; and it is hoped that not only the physico-chemical sciences, but also the biological sciences, to their full extent and application, will soon be enjoying the benefit of the assistance of the industrialists.

To the Italian delegation it seemed that the reciprocal knowledge of the languages of the two countries was the problem that had, in the first place, to be solved; the meetings at the Royal Society of Literature, the lectures delivered at various places that were visited, did much towards assisting the efforts in this direction, and it was certainly a great encouragement to us, coming from Italy at this grave moment to carry on a work of reconstruction, to find so much willingness expressed in the English manner, not in words alone, but in deeds as well, to spread the knowledge of our language, which is the chief and the most effective instrument of our union.

PIERO GIACOSA.

APPLIED SCIENCE IN THE COTTON INDUSTRY.

OPINIONS may differ as to which is the most valuable or most important of the many aspects of this question which were set forth by Dr. Lawrence Balls in a paper entitled "Some Applications of Research to the Cotton Industry," read before the Royal Society of Arts on April 10, and published in the Journal of the society for May 3 (vol. lxvi., p. 389). His contributions to the scientific and practical sides of the problem may appeal in varying degrees to different people, but no one could fail to be impressed by their compelling interest.

The necessity for scientific research is in danger of becoming a catchword which everyone repeats, though few have sufficient knowledge of what it means to have any real faith in it. Dr. Balls has shown that the scientific study of the cotton plant and its environment is essential before the spinner can even describe what he wants in his raw material, in terms which can be translated by the plant-grower into efforts to produce the desired results. Even the question of length of staple has always been dependent on a rule-of-thumb method of determination which left the grower very much in the dark. On this point one might be tempted to award the major importance to Dr. Balls's invention of an ingenious machine which will not merely give the maximum and minimum length of individual hairs in a cotton sample, or even the average length, but will sort them out in graduated lengths and make it easy to measure the total quantity of each length, thus ascertaining accurately the degree of uniformity or otherwise of the staple, which is of prime importance to the spinner. The use of this machine should go a long way towards determining in a really definite way the value of any cotton sample, and may prove the main step towards a method which would enable the grower himself to estimate the suitability of a new cotton for a particular trade.

Equally valuable from the practical point of view was the hint which Dr. Balls's studies of flowering and bolling curves give of a scientific method of forecasting such crops as cotton. If it is not too good to be true, we may live to see the "arrivals" of the crop plotted out weeks in advance, and the probable total yield of the crop foreseen with an accuracy which would certainly be an improvement on the present rather haphazard and sometimes very deceptive methods.

The important results of the work out of which much of Dr. Balls's material arose, in its effects on the water control policy of the Egyptian Irrigation Department, is now a matter of history, but it is one which cannot be told too often either in scientific or official circles as an encouragement and stimulus to the one and a warning to the other.

THE CO-ORDINATION OF ELECTRIC POWER SUPPLY.

THE report of the Committee appointed by the Board of Trade to consider the question of electric power has now been issued (Cd. 9062, price 3*d*.). Several of the questions the Committee had to consider have already been dealt with by the Coal Conservation Sub-Committee, the report of which was described in NATURE of January 3 and February 14 last. The report begins by the statement of several general conclusions on which it bases its recommendations. The first of these is that after the war the success of British industry will depend to a large extent on the adoption of the most efficient methods and machinery, so that manufacturing costs may be reduced to a minimum. In this connection the extension in the use of electric power supplied at the lowest possible price will be a most important factor. The present system of supply by separate authorities to small areas is economically unsound, and prevents the cheapening of the supply. Hence a comprehensive system for the generation of electricity and, where necessary, for reorganising its supply should be established as soon as possible. With these statements every engineer is in agreement. If it had been possible to work on a clean slate, the devising of a suitable scheme under a central authority would have been comparatively easy. Owing, however, to the existence of the present patchwork system and the many conflicting interests which will have to be adjusted, the problem is one of considerable complexity. The Committee advises that a new body to be called the Electricity Commissioners be set up, to whom the existing powers of the Board of Trade

relating to the supply of electricity be transferred. It recommends that the existing system of generating electricity for small areas be abolished. One of the first duties of the Electricity Commissioners would be to divide the country into districts technically suitable for the generation and distribution of electricity. In each district an Electricity Board is to be set up, which will purchase all the generating stations in it. These Electricity Boards are to be financed in whole or in part with Government assistance, and are to make no divisible profits. The Committee laudably strives to conciliate those authorities and engineers who are adversely affected by its proposals. It claims, however, extended powers for the use of overhead wires, wayleaves, and the acquisition of water rights. From the practical point of view the proposals are good, and their adoption, provided that they could be smoothly carried out, would be greatly in the national interests. We hope that Parliament will give to these proposals its most serious consideration.

THE EDUCATION BILL.

THE debate on clause 10, the most important feature of the Education Bill, was resumed in Committee of the whole House on Wednesday, June 5, and continued on June 10 and 11. Sir H. Hibbert submitted, at the instance of many Lancashire Members, an alternative scheme to that of the Bill, whereby, at the option of the local authority, half-time between fourteen and sixteen years of age and thenceforward no compulsory scheme of continued education might be substituted for the proposal in the Bill to require between the ages of fourteen and eighteen a maximum of 320 hours in each year to be included within the ordinary working hours. Mr. Fisher opposed the amendment on the ground that it could not be made mandatory over the whole country, that it would seriously reduce wages, introduce confusion into administration, and would practically double the demand for teachers and for school accommodation. To the great disappointment of many friends of the measure, and especially of this important and vital feature of it, Mr. Fisher, in response to representations not only on behalf of the textile industry, but also in respect of agriculture and of coal-mining, submitted amendments to section i. of clause 10 reducing the compulsory hours in each of the four years from 320 to 280, if the local authority so resolve, and providing that the obligation to attend continuation schools shall not, within the period of seven years from the appointed day on which the provisions of clause 10 (i.) come into force, apply to young persons between the ages of sixteen and eighteen. The Lancashire Members thereupon withdrew their opposition, and Mr. Fisher's amendments were adopted, together with an amendment leaving the local authority free to deal with the times and seasons best suited to the circumstances of each locality. Difficulties of buildings, equipment, and the supply of teachers had doubtless something to do with this decision, but the great advantage gained by the concession is permanently to secure the educational oversight of the adolescent until he reaches the age of eighteen. On Monday Mr. Fisher accepted an amendment by which it was agreed to establish a national scheme for training boys who desire to enter the mercantile marine. Sir Philip Magnus moved to amend subsection 2 in such a way that the recognition of a school as efficient by a British university, equally with such recognition by the Board of Education, should make full-time attendance in that school up to the age of sixteen years a ground of exemption from the obligation to attend continuation schools. After discussion the amendment was withdrawn, and Mr. Fisher agreed to substitute for the words "under arrangements approved by the Board of Education" the words "under regulations made by the inspecting body after consultation with the Board of Education."

It was suggested in the discussion on Tuesday that pressure might be brought to bear upon young persons to attend continuation schools at or in connection with their place of employment. An amendment was afterwards accepted against any such compulsion by a local authority without the consent of the young person or his parents. Clause 10 was finally agreed to as amended.

LIGHT AND VISION.[1]

THE phenomena which take place between the incidence of light on the cornea and the mental appreciation of the fact may conveniently be divided into three stages:—

(1) The production of an image on the retina by means of the dioptric system of the eye. This is purely a physical question, and has been very completely worked out. The only component of a physiological nature is the mechanism of accommodation, by which the curvature of the lens is changed in order to vary the focal length of the system. It would appear that the muscular mechanism here involved is liable to fatigue, and doubtless plays its part in the choice of appropriate methods of illumination, as in the tests used by Ferree.[2] It will also be plain that insufficient illumination requires more exact and tiring accurate adjustment of focus.

(2) When light arrives at the particular layer of the retina known as that of the rods and cones, it excites a photo-chemical change of some kind, which in its turn acts upon the terminations of the optic nerve-fibres and sends along these fibres a series of disturbances which we call nerve impulses.

(3) Arriving at the brain, these impulses are distributed to a complex system of centres composed of nerve-cells, where processes occur associated, in some mysterious way, with the conscious perception of light and illuminated objects.

We naturally ask the question:—What kind of sensation do we experience if the optic nerve is stimulated in other ways, as can be done by means of sufficiently powerful agents? The answer is that whatever be the way in which the optic nerve is stimulated, the sensation is one of light. This statement applies, altering light for sound, taste, etc., to all the nerves of special sense, and is commonly known as Müller's law. In point of fact, it had been formulated by Sir Chas. Bell at an earlier date, though perhaps in not so complete a form. The sensation, then, is an affair of the brain, the "cerebral analysers," as Pavlov calls them, and provided that this part of the brain is set into activity, it matters not by what means, the sensation is the same. This again applies to all the special senses. What, then, is the function of the elaborate structure at the peripheral end of the nerve? Such organs are known in general as "receptors," and their function may be grasped if we try to stimulate the optic nerve by throwing a beam of light upon it. Nothing happens at all, because the nerve-fibres are not responsive to light energy. Some sort of mechanism that is affected by this form of energy must be provided, and is to be found in the rod and cone layer of the retina.

But what is passing along the optic nerve when a light sensation is experienced is identical with that

[1] Abridged from a paper read at the meeting of the Society of Illuminating Engineers on April 16 by Prof. W. M. Bayliss, F.R.S.

[2] Trans. Illumin. Engineer. Soc. (U.S.A.), vol. viii., p. 40, and Ferree and Rand, *ibid.*