organisation. Expressed briefly, brain-power was described as the chief factor upon which commercial progress must depend. Subjoined is a summary of the parts of the speech concerned with this subject:—

We live in a time when we shall fall behind in the race if we do not possess as a nation the gift of organisation. Capital has become the instrument in the hands of the directing brain; and the directing brain for huge concerns of to-day is only big enough if it can embrace in its survey the whole of the competing civilisation. Germany, France, the United States, and other countries are pressing us hard, and it is only by the possession of ideas, by the willingness to work as our forefathers never worked, with the same concentration, we can hope to hold our own in the race. At the bottom of great ideas comes great capacity to organise if they are to succeed; and with great capacity to organise great capacity to think. It is the thinker, the man of ideas, who can translate thought into action, that wins the race of to-day—a race far stiffer, far harder, far nobler, than the easy race of our forefathers. Our universities are growing; our tropical schools are starting; our organisation of commerce is going to be on a larger scale; and yet it is none too soon, because other nations are doing the very same thing. So it comes that the great lesson which this nation has to learn appears to be this—to recognise that mind dominates matter, that brains lie at the root of things, and that upon their working out and the results which brains have provided no progress can be made without that secondary but emphatically valuable faculty is added—the faculty of organisation.

The creation of the Committee of Imperial Defence carried scientific principles into the sphere of government, and was the first step toward getting military and naval notions into order. We now have a general staff which is a body, not to exercise command, but to give advice in a thoroughly practical fashion and in a fashion which can be enforced. The speculation may be indulged in whether one of the great reforms of government to which we are coming—because we have been driven to it—will not be the creation in an organised fashion of just such a general staff for departments of government, and not merely for the Army. A concrete instance may be given of the value of scientific advice. In two parts of the dominions of the Crown there are diseases of a terrible character raging at this moment. One is understood, because it has been dealt with by the scientific experts of the Government, but the other is not, because there are no scientific experts to deal with it. The first case is in India, where research work is carried out by experts whom the Indian Government has organised, and who are out working in the subordinate departments of the Government, exercising no authority, but giving advice and reporting to headquarters. These investigators and advisers have brought the plague in India within compass. Then, to give a second case, in one of the West Indian islands, possibly in more, there flourishes what is called tropical anæmia, which, although not fatal to life in the ordinary sense, reduces the working power of its victims by 30 per cent. or 40 per cent. This is a sheer loss to the State, and yet the disease can be and has been combated in other parts of the world. This disease, which also exists in our mines, where it is known as ankylostomiasis, was recently very familiar in Westphalia, and the German Government, working on general staff principles, dealt with the scourge on scientific principles from the beginning. The disease exists in our Cornish mines, but we have not extirpated it as thoroughly as the Germans have.

If people were but aware what can be accomplished and what can be saved to the State, and the extent to which our community can be made more efficient by dealing with these things on a scientific footing, the nation would be wiser and better. This may seem to be the bureaucratic point of view, but when it is founded on science it is the right point of view; and the governments of the future will find more and more work of this kind forced upon them.

THE REV. DR. JOHN KERR, F.R.S.

JOHN KERR, the discoverer of the Kerr effect in magneto-optics, was born at Ardrossan, Ayrshire, December 17, 1824, and received part of his early education at a parish school in Syke. He graduated M.A. with honours in 1849 at Glasgow University, where he greatly distinguished himself, especially in mathematics and natural philosophy. He completed the usual course in theology at the Free Church College in Glasgow, but, instead of entering on a clerical career, became in 1857 mathematical lecturer in the Free Church Normal Training College for Teachers in Glasgow, an institution which has recently passed under the direct control of the Scottish Education Department. Here for forty-four years he trained in mathematics and physics thousands of our youth who afterwards filled important scholastic positions. On his retirement in 1901 his old pupils entertained him at a banquet, when Prof. Magnus Maclean in their name presented him with a tea and coffee service, and made a graceful reference to his great work.

In 1867 Kerr brought out an "Elementary Treatise on Rational Mechanics" (Hamilton, Glasgow), which deserves more than a passing notice. While adhering to the usual mode of treatment at that time, namely, first statics and then dynamics, he introduced what was then a novelty in English books, a separate chapter on kinematics as a preliminary to the chapters on kinetics. Numerous examples are appended to the various chapters, and it is doubtful if among the many more modern treatises of similar standard a better working book for the student exists. Every here and there the physical mind of the author is in evidence, especially in an appendix or "Note," the object of which "is to give a sketch of some of the simpler facts connected with the manifestations of force in nature." Elasticity, cohesion, capillarity, electricity, magnetism, physical optics, and sound are briefly commented on; and the conservation of energy is discussed under that name. The book was written before the formal appearance of Thomson and Tait's "Natural Philosophy," but no doubt under its influence. It is interesting to note that Kerr returns to Newton for the true foundation of dynamics.

In 1875 Kerr published his first paper "On a New Relation between Electricity and Light: Dielectric Media Birefringent" (*Phil. Mag.*, vol. l., pp. 337–348 and 446–458). Accepting the Faraday theory of electric strain, he constructed a remarkably simple form of apparatus in which the ends of two terminals in connection with the open secondary circuit of an induction coil were brought to within a quarter of an inch of each other in the heart of a plate of glass. Nicol prisms were arranged for extinction with their principal axes at angles of 45° with the line of terminals. When the induction coil was set in operation light was restored by the birefringent action of the electrified glass. The investigation was soon extended to liquids, such as bisulphide of carbon, benzol, paraffin, &c. By an extremely neat and simple use of a compensator of mechanically strained glass inserted in the path of the polarised ray, he proved that electrified glass acted upon transmitted light like a negative uniaxal crystal with its axis parallel to the lines of electric force. Quartz acted like glass, but resin acted like a positive uniaxal, as if it were extended along the lines of force. In later papers, published at intervals in the *Philosophical Magazine* between 1879 and 1882, he continued this research with more elaborate apparatus, and extended it to a great many substances, establishing, among other

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things, the law that the optical effect varies as the square of the resultant electric force.

At the meeting of the British Association in Glasgow in 1876, the president, Prof. Andrews, made a pointed reference to these early experiments of Dr. Kerr, but little dreamed that in a few days the whole scientific world would be positively "electrified" by the announcement of the great discovery known as the Kerr effect. Not only did Kerr announce the discovery, but he demonstrated it with the simplest of apparatus before the meeting of Section A. The paper containing a full account of these experiments was published in 1877 (*Phil. Mag.*, vol. iii., pp. 321–343). The great fact established was that the plane of polarisation of a ray of plane polarised light reflected from the end of the iron core of an electromagnet is rotated under influence of the magnetising current, in a direction contrary to the conventional direction of the current. In a later paper (*Phil Mag.*, vol. v., pp. 161–177) the like phenomenon was established for light reflected from the sides of the magnetised iron. These remarkable experiments form the starting point for a prolonged series of delicate measurements in magneto-optics by several experimenters, of whom we may mention specially Righi, Kundt, Du Bois, Sissingh, Zeeman, and Drude.

On the theoretical side Fitzgerald (*Phil. Trans.*, 1880) was the first to attempt a discussion of the Kerr effect. In this effort he broke "new ground," as Maxwell expressed it; and although the theory was not comprehensive enough, nevertheless (to quote from Larmor, who has himself greatly developed the whole electromagnetic theory) "Fitzgerald's analytical work still remains applicable. The extension to metallic media is now formally made, as Ohm's law indicates, by taking the refractive index to be a complex quantity; with this generalisation the analysis has been extended by various writers, including Lorentz, Goldhammer, and Drude, but most completely by Leathem and Wind, and shown to embrace satisfactorily all the mass of detail that has been brought out in recent years in experimental magneto-optic investigations."

Dr. Kerr's latest paper on this subject (*Proceedings of the Royal Society*, 1894) described experiments on a fundamental question in electro-optics: "Reduction of Relative Retardations to Absolute." In 1888 (*Phil. Mag.*, xxvi., pp. 321–341) he published a well-planned and carefully-executed series of experiments on the birefringent action of strained glass. His last contribution to scientific literature was a note read before the British Association in 1901 on the "Brush Grating and its Optical Action."

Before the great scientific events of his life the University of Glasgow showed their appreciation of Dr. Kerr as an educationist by conferring on him in 1868 the honorary degree of Doctor of Laws. He was elected F.R.S. in 1890, and was awarded a Royal medal in 1898. He died August 18, 1907, after enjoying six years' retirement from official duties in the Normal College. Here, in limited accommodation, with still more limited apparatus, and only by devoting evening hours and precious holidays to research, John Kerr made the discoveries which have linked his name for all time with that of the immortal Faraday.

C. G. K.

NOTES.

PROF. M. H. E. TSCHERNING, director of the ophthalmological laboratory of the Sorbonne, Paris, has accepted the invitation of the council of the Optical Society to deliver the first Thomas Young oration on Thursday, October 17, and has chosen for its title "The Development of the Science of Physiological Optics during the Nineteenth Century." The oration has been established for the purpose of providing an annual lecture on some subject connected with physical, geometrical, or physiological optics, and thus to further the development of those branches of science with which the name of Thomas Young is intimately associated. The orator is elected annually by the council of the Optical Society from persons eminent in these branches of science or technology.

A VERY interesting and instructive exhibit has just been added to the public galleries of the geological department of the British Museum (Natural History) in the form of an enlarged wax model of the Silurian arachnid *Eurypterus fischeri*. Remains of these creatures are found in such a wonderful state of preservation in the Upper Silurian strata of Oesel, in the Baltic, that Prof. G. Holm has succeeded in freeing from the matrix considerable portions and mounting them on glass slides in Canada balsam. The original chitin is preserved in an almost unaltered condition, and even the most minute details of the external surface are retained. From these materials it has been possible, under the superintendence of Dr. Calman, to construct the model now exhibited, which is double the natural size, and appears to be between 7 inches and 8 inches in length. The model is temporarily placed in the central hall.

WE learn from the *British Medical Journal* that a movement for the foundation of an institution which is to bear the name of Prof. Robert Koch is on foot in Germany, and a committee has been formed with the object of collecting money for the purpose. The chairman is Dr. von Studt, Prussian State Minister; the vice-president, Privy Councillor Althoff; the secretary, Prof. Schwalbe, editor of the *Deutsche medizinische Wochenschrift*; the treasurer, Dr. Paul von Schwabach, General Consul, Berlin. The institution, which is to be applied to the furtherance of research in all directions for the discovery of means of checking the diffusion of tuberculosis, is intended to be a permanent memorial of the discovery of the tubercle bacillus by Prof. Koch twenty-five years ago. Appeal is made for contributions sufficient to make the institution a tribute of gratitude to Koch, similar to those with which the name of Pasteur has been honoured in France and that of Lister in England.

IT is announced in the *Times* that the Government has completed negotiations for the purchase of the estate of Inverliver, Argyllshire, with a view to its conversion into a State forest. The estate, which has an area of about 12,530 acres, extends for about nine miles along the western side of Loch Awe, stretching across to Loch Avich. It will be of much value as a centre of education in forestry, and arboriculturists in Scotland are gratified that their desires for the establishment of a demonstration area are about to be realised. The afforestation of Inverliver will at once be proceeded with according to a general scheme, which provides for a certain number of acres being planted each year. The estate will be under the management of the Office of Woods and Forests, and, though it will yield no immediate return, it is expected

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