work of an educational expert who has certain ideals, and does not hesitate to show how far existing conditions differ from them. Strong opinions are given on the vexed question of the London hospital medical schools, and on the constitution of London University. How far the recommendations are practical is a question that must be left for the authorities concerned to decide. It is certainly desirable that London as a teaching centre of medicine should not occupy a position inferior to the great schools of Berlin, Vienna, and Paris.

Whatever we may think of some of the author's criticisms, one cannot but admire the ability and thoroughness with which he has collected information and drawn up his report. Educationists generally, and medical teaching authorities in particular, owe a debt of gratitude to the Carnegie Foundation for the Advancement of Teaching.

LIQUID CRYSTALS AND THE X-RAY WORK.

IN two memoirs contributed to the current volume of the *Verhandlungen des Naturwissenschaftlichen Vereins*, Karlsruhe, Prof. O. Lehmann gives a valuable summary of his well-known researches on the so-called liquid crystals, and reviews the proofs now available of molecular structure and of the operation of molecular forces, and especially the tangible proofs of the actual existence of molecules. Naturally, the most interesting part of such a communication from Prof. Lehmann is the expression of his views concerning the most recent of such proofs, afforded by the experimental work of Laue, Friedrich, and Knipping with X-rays and crystals at Munich and Zurich. The events leading up to this remarkable development are clearly indicated, and their individual significance emphasised. From the initial stages of the kinetic theory of gases in the days of Count Rumford and Robert Mayer—the former of whom was connected with Munich, and is there represented by a fine statue—to the reflection of X-ray electromagnetic waves from the invisible parallel planes of atoms in the interior of a crystal, and the impression of the systematic symmetry of the crystal on a photographic plate by the reflected rays, is a long step.

It will be with universal consent that Prof. Lehmann hails this new work as of richest consequence not only to crystallography, but to general physics. He considers it the first practical proof of the existence of those molecular forces which he has so long contended for as causing the deposition, layer upon layer in regular order, of the chemical molecules in their erection of the edifice of a crystal—that is, in the production of a three-dimensional grating or "space-lattice."

One of the surest signs of the magnitude of the discovery made at Munich is the fact that the experiments, as on the occasion of the discovery of radium, are being repeated and extended by numerous workers all over the world, as the columns of NATURE, in which many of the results have been described, have lately abundantly testified.

It is a generally accepted maxim amongst men of science that the pioneer of a new discovery should be permitted to work out undisturbedly its further development, and it is sincerely to be hoped that Prof. Laue and Drs. Friedrich and Knipping will be able to carry their work to its logical conclusion. The bearing of the discovery on Prof. Bragg's theory of X-rays has, however, fully justified its further independent investigation by him and by his son, Mr. W. L. Bragg, who has crystallographic knowledge, and has added very considerably to the subject, both by further experiments and by an explanation which agrees with the crystallographic facts in a most remarkable manner. There are indications that the near future will see a surprising further development in the direction of arriving at the absolute dimensions of the cells of the space-lattice—that is, of the actual distances separating the chemical atoms, thus converting the topic axial ratios, which have been so useful a conception for affording us the relative dimensions of the cells in related compounds, into absolute spacial values. Moreover, the dimensions of the material parts of the atoms themselves appear likely to be also determinable within definite narrow limits, for the reflector, the atom, must be larger than the wave reflected, and it is now clearly proved that an ordinary reflection, and not a diffraction effect, is in question.

Another secondary result is that the intensity of the reflection is proving a direct function of the density with which the atoms are strewn in the reflecting plane, thus affording us an experimental means of carrying out Prof. von Fedorow's quest for the primary facial planes, so as to arrive at a proper descriptive setting for the crystal; for these primary planes, sometimes obscured by fortuitous better development of other planes on the exterior of the crystal, are invariably those most densely strewn with the atomic points.

For a discussion of the physics of the whole subject, especially as regards the position immediately before the Munich discovery, the two memoirs of Prof. Lehmann forming the subject of this notice may with advantage be consulted. A brief abstract of some of the most recent work of Mr. W. L. Bragg will be found in the report of the proceedings of the Mineralogical Society of June 17 (see NATURE of June 26, p. 441).

A. E. H. TUTTON.

THE PILTDOWN SKULL.

AMONG the questions discussed by the anatomical section of the International Congress of Medicine was the date and reconstruction of the famous Piltdown skull. At South Kensington the fossil portions of the skull have been put together by Dr. Smith Woodward so as to represent a being partly ape, partly human, and named *Eoanthropus dawsonii*. From this model the brain gives a capacity of 1076 c.c.—an amount

intermediate between the highest anthropoid and the highest form of man.

Dr. Smith Woodward fixes its date in the very early Pleistocene period, contemporary with the well-known Heidelberg jaw. Prof. Rutot, of Brussels, assigns the Piltdown stratum of gravel in which the remains were found to the latter part of the Pliocene period. If these views be accepted, it is of much earlier date than the remains of Neanderthal man recently discovered in France; and while Prof. Rutot estimates the duration of the Pleistocene period at 150,000 years, Prof. Penck, one of our greatest authorities on the Glacial period, estimates its duration from half a million to a million and a half of years.

On the other hand, Prof. Keith, of the Royal College of Surgeons, has articulated the portion of the skull to represent a large and well-modelled human head with a brain capacity of 1500 c.c—an amount slightly above the average of modern human brains.

The difficulty of accepting Dr. Smith Woodward's reconstruction is in believing that Eoanthropus could be transformed into modern man in the short period represented by the first half of the Pleistocene period. On the other hand, to quote the admirable summary of the question in *The Times* of August 11, "if Prof. Keith is right, then it is quite possible that mankind may have reached the stage represented by the Galley Hill remains before the middle of the Pleistocene period. If Dr. Smith Woodward is right, we have to seek the beginnings of our modern culture and civilisation at the middle of the Pleistocene period; if his opponent's reconstruction is well founded, we have to go a whole geological period further back—perhaps a million of years—to find the dawn of modern man and his culture."

In the discussion which took place, reported in *The Times* of August 12, the weight of scientific opinion seems to have been decidedly in favour of the views of Prof. Keith. But the importance of the question is so vital to the science of anthropology that we may be well advised to await further developments of the controversy.

HELMINTHS AND CANCER.

IN a memoir recently published,[1] Dr. Johannes Fibiger brings forward strong evidence in support of the view, by no means novel, that the lesions of the tissues produced by parasitic worms may act as the starting-point for the development of cancerous growths and tumours. The author found in wild rats a disease of the œsophagus and stomach characterised by an epithelial proliferation and inflammation leading, in pronounced cases, to a papillomatous growth which was the precursor of a malignant epithelioma. Examination of the primary lesions revealed the presence of a nematode worm, an undescribed species of Spiroptera.

From a series of experiments it was concluded that cockroaches (*Periplaneta americana* and *P. orientalis*) serve as intermediate hosts for the Spiroptera. The cockroach becomes infected by ingesting eggs of the worm which are passed out in the excrement of the rat; the eggs develop in the cockroach and the embryos of the worm become localised in the striated muscles of the prothorax and the legs. The rats become infected by eating cockroaches, and the embryos of the worm, set free from their cysts, attack the epithelium of the stomach, sometimes also that of the œsophagus or buccal cavity, and develop into the adult nematode, the cause of the lesions already mentioned. From his investigations the author concludes that all the anatomical alterations are due to toxic products of the nematode.

From the primary lesions caused by the nematode secondary metastases may be produced in other organs. The metastases contain neither the parasites nor their eggs. The development of the metastases is ascribed to the faculty of the epithelial cells to multiply in other organs independently of the parasite. The author thus confirms the view put forward by Borrel and others that nematodes may produce malignant tumours in rats and mice, and considers it not improbable that in human pathology also cancerous tumours may owe their origin in some cases to the presence of helminths.

[1] Oversigt Kgl. Danske Videnskabernes Selskabs Forhandlinger, 1913, No. 1.

NOTES.

A CIRCULAR from the Institut International de Physique Solvay informs us that a sum of 20,000 francs is available for the encouragement of experimental work in physics and physical chemistry, particularly for investigations on radiation phenomena (Röntgen rays and those of radio-active bodies) and for studies of the theory of energy quanta and of molecular theories. Grants from the fund will be awarded, without distinction of nationality, by the administrative commission of the institute on the recommendation of the international scientific committee. The administrative commission is composed of Profs. P. Heger, E. Tassel, and J. E. Verschaffelt, Brussels, and the scientific committee of M. H. A. Lorentz, president, Haarlem; Mme. M. Curie, Paris; M. Brillouin, Paris; R. B. Goldschmidt, Brussels; H. Kamerlingh-Onnes, Leyden; W. Nernst, Berlin; E. Rutherford, Manchester; E. Warburg, Berlin; and M. Knudsen, secretary, Copenhagen. Applications for grants should be made before September 15 to Prof. H. A. Lorentz, Zijlweg 76, Haarlem, Holland. They should state precisely what problems are to be investigated, the proposed means of inquiry, and the amount required, in order that the committee may have before it all details necessary in considering the awards to be made.

AN exhibit illustrating the damage caused to biscuits sent out in soldered tins for the use of the troops in South Africa—especially during the Boer war—Gibraltar, Malta, Ceylon, &c., has just been placed in the central hall of the British Museum (Natural History), where it will be kept open about a month. The larvæ of certain minute moths and beetles were the active agents; and it appears that since these