the large scale of its operations, offers the most promising field in the world for research in the domain of education, which is the "key" to all original investigation, scientific or industrial, and in connection with the national movement for reconstruction. It includes the study of the mental development of the individuals to be educated and the study of the teaching methods most effective in securing that end. It is therefore proposed to encourage and aid extended educational research. The total estimated expenditure of the Education Committee of the Council for 1920–21 is estimated at 11,711,379*l.*, being for elementary education 9,351,294*l.* and for higher education 2,360,085*l.*, of which sum 5,514,206*l.* is raised from rates, or a rate of 2*s.* 5*d.* in the pound. A forecast is given of the *additional* expenditure in London arising out of the requirements of the Education Act, 1918, which will in 1920–21 amount to 116,000*l.*, and gradually increase until in 1930–31 it is estimated that it will be 3,037,500*l.*, of which sum taxation will bear half the cost, the other half being raised by an additional rate of 8*d.* in the pound on the present assessment. The report extends to 100 pages, and is abundantly illustrated by diagrams, maps, tables, and illustrations of buildings.

The Society of Chemical Industry.

THE Society of Chemical Industry held its thirty-ninth annual general meeting at Newcastle-upon-Tyne on July 13–16, this being the fourth occasion upon which the society has selected Newcastle as its meeting place. Appropriately enough, a series of papers dealing with the manufacture of coke was read and discussed at the first business meeting, whilst the second was devoted to papers dealing mainly with miscellaneous metallurgical questions. Simultaneously the Chemical Engineering Group of the society held a conference devoted to problems connected with filtration and allied methods of separating liquids from solids.

Among the first day's papers two dealt with coke-oven construction. Mr. W. A. Ward discussed "Modern By-product Coke-oven Construction" from the point of view both of the best type to be adopted in different circumstances and of the details of design of the oven itself. Mr. Ward pointed out that the generally accepted view that the regenerative oven is more efficient than the non-regenerative oven is not strictly correct, and that in either case "the surplus energy is the same, because the amount of heat necessary to coke the coal is the same. . . . The difference lies simply in the manner in which the surplus heat is made use of." He showed that it is true that the former type can generally produce a larger amount of power available for use outside the coking plant, but that this is due to the fact that the former uses the more efficient form of power generation, namely, the gas engine as compared with the steam engine. Mr. Ward remarked also that there is no reason why any one of the various types of modern coke-oven should give better results than any other. He proceeded to give much useful information on details of construction; for example, he held strongly with the advantages to be gained in most cases by compressing the coal, but advocated the use of the modern electrically driven top-charging machine instead of the machine making a compressed cake of coal, which is then pushed into the oven, and he gave short descriptions of the modern methods for quenching, screening, and loading the coke.

Mr. W. J. Rees contributed a paper on "The Corrosion of Coke-oven Walls," which he attributed mainly to the sodic chloride and sodic sulphate in the coal, and pointed but that hot, moist air carrying salt vapour has a highly corrosive action on fireclay bricks, much more, in fact, than on other refractory bricks. In the salt glazing of bricks the saline vapour is allowed to come in contact with the brick only at a temperature of about 1200° C., at which the chemical action is rapid; in the coke-oven, on the contrary, the walls of the oven never attain this temperature, with the result that the salt vapour penetrates into the interior of the brick and turns it into a weak, spongy mass, easily broken away. It would appear that the best brick for ovens carbonising salty coal is a good silica brick.

Mr. Harold E. Wright, in his paper "Coke-oven Gas for Town Supply," showed that illuminating gas can be produced more economically in the coke-oven than in the gas retort, and that, wherever circumstances permit of its adoption, the regenerative coke-oven producing metallurgical coke can supply better and cheaper gas to the town consumer than can the ordinary process of gas manufacture.

Dr. E. W. Smith, in "By-products from Coke-oven Gas," dealt with a similar subject from a somewhat different point of view, but came to the same conclusion, stating that it is only necessary to remove sulphuretted hydrogen from coke-oven gas in order to make it suitable for town supply, and that experience at Birmingham has shown that the yields of by-products from coke-ovens were just as good as from horizontal gas retorts.

Messrs. G. W. Henson and S. H. Fowles contributed a paper on "The More Economical Utilisation of the Coke-oven and Blast-furnace Gases for Heating and Power." They added numerous data and calculations to support the view which has been repeatedly put forward within recent years, that with regenerative coke-ovens built near the blast furnaces and steelworks, and with proper cleaning of the blast-furnace gases (for which they apparently prefer the Halberg-Beth method), better results are obtained in iron and steel manufacture and a large surplus of power can be generated by means of gas engines, which can supply all the power required by a modern iron and steel plant, whilst a considerable proportion of the coke-oven gas can be utilised in the melting furnace. They also suggest that a certain proportion of the electricity generated can be applied to the finishing of the steel manufacture in the electric furnace, which they consider has no competitor as an appliance for refining steel.

Amongst the metallurgical papers was one on "Some Properties of 60–40 Brass" by Prof. C. H. Desch. Such brass contains two constituents, the α solid solution containing 70 per cent. of copper and and β solid solution with 53·5 per cent. of copper; this latter constituent is plastic at high temperatures, and enables the metal to be hot-rolled, worked, or extruded. It was found in practice, however, that such brass varied greatly in the ease with which it could be machined, and the present paper deals with the reasons for such variation, which was traced to differences of structure. A fine fibrous structure was found to give the best results, and this can be obtained by using brass containing as nearly as possible 40 per cent. of zinc, extruded at a moderate temperature in very powerful presses.

Mr. D. W. Jones, in a paper on "Chemical Sheet-Lead," showed the importance of using the purest possible lead in connection with acid plant, but that in case of need copper will to some extent counteract the injurious effect of antimony and bismuth.

Mr. D. F. Campbell described "Recent Developments of the Electric Furnace in Great Britain," and showed the progress that had been made in this branch

of metallurgy: "In 1914 the quantity of energy used in electric furnaces in Britain, excluding those used for aluminium, was probably less than 6000 h.p., but on the day of the armistice the total capacity was in excess of 150,000 h.p." The author held that furnaces of more than 25 tons or above 3000-kw. capacity are not advantageous, and that the arc furnace has practically displaced the induction furnace. He pointed out the various existing applications of the electric furnace, and indicated the probable future development of this valuable appliance.

Dr. E. F. Armstrong read a paper on "Catalytic Chemical Reactions and the Law of Mass Action," in which he reviewed the present state of our knowledge of catalytic reactions, particularly as applied to the hydrogenation of certain oils. He held that the curve of catalytic action is linear and not logarithmic, and that the latter curve has been obtained by a number of observers owing to the fact that they had been working on substances in which some poison formed part of the substance to be hydrogenated, which destroyed the catalysts and thus gave the curve a logarithmic form. He further claimed that catalytic action is not a purely physical phenomenon, but is due to the formation of loose additive chemical compounds, of the existence of which he produced some evidence.

At the conference of the Chemical Engineering Group the theory of filtration was discussed in two papers, "The Principles of Technical Filtration," by Dr. E. Hatschek, and "The Design of Mechanical Filters," by Mr. Balfour Bramwell, whilst the filtration of gases was dealt with by Mr. J. M. Brown. Mr. E. A. Alliott contributed a paper on "Recessed Plate and Plate-and-Frame Types of Filter Press: Their Construction and Use," in which he compared the two types and the details of their construction; he also discussed various methods of feeding, the selection of filter-cloths, and other important points in the use of filter presses, and gave data as to the results obtained in certain typical examples.

Three papers dealt with centrifugal machines, namely, "The Sturgeon Automatic Self-Discharging Centrifuge for Separating Solids from Liquids," by Mr. R. A. Sturgeon; "The Sharples Super-Centrifuge," by Mr. S. H. Menzies; and "A New Process for Centrifugal Filtration," by Mr. W. J. Gee. The last-named appliance differs from most centrifugal machines in that it makes use of a filtering screen, so that it does really perform a process of filtration. Dr. W. R. Ormandy in his paper, "The Filtration of Colloids," showed the effect of electro-osmotic action on colloids and suspensoids, and illustrated these by a series of experiments with a suspension of clay.

Imperial Cancer Research Fund.

THE eighteenth annual meeting of the Imperial Cancer Research Fund was held on July 22, the Duke of Bedford presiding. Sir William Church, in moving the adoption of the report, gave a summary of the investigations during the past year; in this he stated that the Director had continued the autologous grafting experiments, in which by transplanting an animal's own tumour to a part of its body away from the site of the primary growth an artificial secondary growth is established. The formation of secondary growths is the most certain evidence of the cancerous nature of a growth. It is to be hoped, therefore, that this method will be more widely applied as a control in the experiments on the production of cancer by chronic irritants which are being undertaken in so many laboratories throughout the world. In these experiments the most definite proof of malignancy is essential to progress.

Dr. Cramer has examined the action of a number of inorganic substances on cancer cells. The first step in these investigations is to expose emulsions of a transplantable tumour to the reagent in the test-tube and find out by inoculating the treated emulsion into susceptible animals the amount of damage produced. Salts of cerium were found to be the most active of those tested. Manganese and uranium salts were less potent, and the other elements experimented with were without effect in strengths which could be tolerated by the experimental animals. None of these substances, however, had any influence on growing tumours—a failure probably due to the irregularity of the circulation in the tumours, which delays the access of the reagents to the cells, coupled with their rapid elimination by the kidneys and bowels. This is one of the difficulties constantly met with in direct therapeutic experiments on cancer. The cancer cell is so like the normal cells of the body that agencies which destroy it are also dangerous to life.

Before we can plan a rational method of treatment it will be necessary to know more of the vital processes in cancer cells and the nature of the very delicate differences between them and the normal. A beginning has been made with the study of cell-respiration. Respiration is essentially a combustion process, oxygen being taken in and carbon dioxide given off. These are only the first and last terms, however, of a series of chemical equations, so that there is room for great variety in the intermediate stages, even if the final result should be the same.

Dr. Drew has approached the problem by studying the rate of decolorisation of dilute methylene-blue solution by normal and cancer cells. With this method there is a wide difference between the two, decolorisation being much more rapid with normal cells. Dr. Russell and Dr. Gye have suspended the tissue emulsions in fully oxygenated defibrinated blood and measured the rate at which oxygen is abstracted on incubation at body-temperature. By this second method the differences are much less pronounced, and it is found that the more rapidly growing tumours, with significant exceptions, absorb more oxygen than those which grow slowly. The investigations are being continued, and give promise of interesting light on this fundamental feature of the life of cancer cells.

The Duke of Bedford, in moving a vote of thanks to the executive committee and to others who have assisted in the work of the Fund during the past year, referred to the wide range of investigation, covering such important researches as those relating to (1) experimental induction of cancer; (2) respiration in normal tissues, which is a fresh line of research in connection with cancer; and (3) experiments on the action of chemical substances on cancer cells in the test-tube and in the body; and to the very technical investigation of the Director on grafting; and noticed with satisfaction that the Fund is again in a position to assist investigators at home and abroad with tumour material for experimental purposes.

Liverpool School of Tropical Medicine.

THE Sir Alfred Jones Laboratories of the Liverpool School of Tropical Medicine were formally opened by Lord Leverhulme on Saturday, July 24, Sir Francis Danson, chairman of the School, presiding. Prof. J. W. W. Stephens announced the award of the Mary Kingsley medal to the following distinguished scientific workers:

DR. A. G. BAGSHAWE, C.M.G., well known for his researches on sleeping sickness in Uganda. Since 1908 Dr. Bagshawe has been director of the Tropical Diseases Bureau and general editor of the Tropical Diseases Bulletin. This publication occupies a unique