Studies in Oxidation-Reduction.[1]

THIS bulletin, obtainable for a mere half a dollar, consists of reprints of the masterly series of researches published by W. Mansfield Clark and his associates from 1923 onwards. Twelve pages of supplementary notes have been included. The principal author, well known for his valuable book on "The Determination of Hydrogen Ions", was quick to appreciate that Gillespie's measurements of the electrode potentials induced by bacterial reduction, published in 1920, revealed a method whereby it might be possible to accumulate *quantitative* data concerning oxidation and reduction. The first paper outlines the theoretical aspect of the problem and shows how it is possible to express relative oxidation-reduction intensities in terms of electrode potential. For each system a constant can be found which is a measure of its oxidation-reduction *intensity*, a matter quite apart from the *capacity* of a solution to oxidise or reduce. A series of substances can therefore be arranged, so that when themselves in the half-oxidised or half-reduced state, each one will tend to oxidise one with a more negative constant, and to reduce one with a more positive constant.

The second paper is devoted to a consideration of the theoretical relations between reduction potentials and hydrogen ion concentration. Oxidation or reduction will displace *p*H in one direction or another in accordance with the acidic or basic nature of the group destroyed or created.

The third of the series relates to an experimental study of the electrode potentials of 1-naphthol-2-sulphonic acid indophenol and its reduction product. It includes a valuable description of apparatus and methods.

The fourth deals similarly with the indigo sulphonates, and the fifth with simple indophenols, dibromo substitution products of phenol indophenol and substituted indophenols of the ortho type being studied in the sixth, while the seventh discusses the dichloro substitution products of phenol indophenol.

The eighth is devoted to methylene blue, a substance of great histological and physiological interest, since it is a most useful *intra vitam* stain. The bibliography on methylene blue occupies nineteen pages, with about four hundred and fifty citations, and is probably the most complete in existence.

The ninth is entitled "A Potentiometric and Spectrophotometric Study of Meriquinones of the *p*-Phenylene Diamine and the Benzidine Series". The behaviour of these substances is so complicated, and the tendency to autoxidation is so considerable, that the authors consider it extremely dangerous to draw conclusions from colour reactions with benzidine, *p*-phenylene diamine, and their homologues. In view of the vogue these substances have had as oxidase reagents, the warning should not be forgotten.

The tenth deals with reduction potentials in cell suspensions. Relatively wide spans of potential are covered. Various aspects of the experimental data seem to indicate that cell suspensions are poorly poised with respect to the electromotively active material present at any moment, but that active material is slowly mobilised by cell catalysts from some large reserve. Several of the implications of current theories regarding biological oxidation and reduction are discussed. This discussion and the experimental data lead to the conclusion that the immediate problem is a clearer definition in *experimental* terms of the isolated chemical systems found in the cell.

The supplementary notes supply valuable additions and some trenchant criticism of subsequent work. Attention is directed to the necessity for a clear distinction between "the intensity factor measured in any proper terms but expressed by us in volts, and the capacity factor expressed in chemical equivalents or in faradays". The product is a work term and has nothing whatever to do with kinetics. "Therefore the term reducing *power* (power involves a *time* factor) should never be applied in descriptive text dealing with equilibrium states. The term *reducing ability* is often meant where *reducing power* is used."

The eleventh paper of the series, dealing with toluylene blue, is not included, but some data concerning this compound are included in the supplementary tables.

It cannot be pretended that these papers are anything but difficult reading; the conceptions set forth in them are, however, of fundamental importance; one can search current text-books in vain for any mention of them—though the series started in 1923, and the tenth appeared in 1926. It is to be hoped that all future workers on plant and animal respiration will carry on their researches with a due regard for the theoretical considerations and the exact quantitative data presented by this brilliant American chemist and his collaborators. In its orderly correlation of a large mass of data, in a region which before was in chaos, one is reminded of Loeb's work on "Proteins and the Theory of Colloidal Behaviour".

[1] Treasury Department: United States Public Health Service. Hygienic Laboratory Bulletin No. 151: Studies on Oxidation-Reduction, I-X. By the Staff of the Division of Chemistry. Pp. vi+363. (Washington, D.C.: Government Printing Office, 1928.) 50 cents.

University and Educational Intelligence.

EDINBURGH.—Dr. Thomas W. M. Cameron, of the London School of Hygiene and Tropical Medicine, has been appointed lecturer in helminthology in the Department of Zoology of the University and in the Royal (Dick) Veterinary College. Mr. A. L. Bennett has been appointed lecturer in zoology in the University.

MANCHESTER.—The Council has appointed Mr. N. F. Mott to be lecturer in mathematical physics.

The Grisedale Scholarships for biological research have been increased in value to £200 each, and awards have been made to Dr. Miriam K. Bishop (botany) and to Mr. Ieuan Thomas (zoology).

SIR FRANK HEATH has accepted the invitation of the executive committee to become the secretary of the Universities Bureau of the British Empire. Sir Frank Heath was permanent secretary of the department of Scientific and Industrial Research, and previously principal assistant of the Board of Education for England and Wales in charge of the universities and training colleges branch of the Board.

THE London County Council has awarded Robert Blair fellowships, which carry a grant of £450, to Mr. C. G. Davies, of Gorseinon, Glamorgan, and to Mr. G. L. Riddell, of Muswell Hill, London. Mr. Davies, who is works manager of the Grovesend Steel and Tinplate Company, Gorseinon, will carry out a detailed investigation into modern developments of practice in steel sheet, tinplate, and galvanised sheet manufacture in the United States. Mr. Riddell will study printing and its allied trades in relation to its machinery processes and methods of production in Canada, the United States, and Germany.

FOLLOWING on the representations made in Australia last year on behalf of the Colonial Office by Major R. L. Furse, the Prime Minister has appointed a central committee of advice in connexion with the

making of selections from graduates nominated by the various Australian universities for appointment to the Colonial Service. The chairman is General Sir Brudenell White, and the other members are the Hon. F. W. Eggleston, Dr. J. H. L. Cumpston, Dr. A. C. D. Rivett, Major Keith Officer, and Mr. S. S. Addison (secretary). This move will be appreciated in the Commonwealth, though it is improbable that many candidates will be available for some years for scientific posts in the Colonies, particularly in biological divisions of work.

THE following awards for the year 1929–1930 have been made by the Salters' Institute of Industrial Chemistry and approved by the Court of the Salters' Company. Fellowships have been renewed to: Mr. C. G. Akhurst, Imperial College, London (Fellow, 1927–1929), for a further year at the Imperial College of Tropical Agriculture, Trinidad; Mr. H. K. Cameron, University College, London (Fellow, 1928–1929, at the University of Munich), for one year; Mr. H. Diamond, University College, London (Fellow, 1928–1929, at the University of Munich), for one year; Mr. F. L. Gilbert, University College, Nottingham, and Cambridge (Fellow, 1928–1929, at Cambridge), for one year; Mr. C. H. Lea, University of Liverpool (Fellow, 1928–1929, at Cambridge), for a further year at the Low Temperature Station, Cambridge. Fellowships have been awarded to Mr. C. G. Eltenton, Trinity College, Cambridge; Mr. D. L. Hodge, Imperial College, London; Mr. L. C. Bannister, Universities of Liverpool and Cambridge. The Institute has also awarded one hundred grants-in-aid to young men and women employed in chemical works, to facilitate their further studies.

IN several articles in the *Times of India*, under the title "Mathematics and Life", published last year in pamphlet form, Prof. John Maclean, Wilson College, Bombay, advocates a reform in the teaching of mathematics in the first year of university study. Hitherto at Bombay the student who is not a mathematical specialist has looked on mathematics as a fence that he must climb as best he can and then forget about, as a mere obstacle without connexion with his future life. Prof. Maclean's aim is to give the student an equipment of mathematics that will be of direct use to him in after life, whatever walk in life he may have chosen. His course would exclude all portions of mathematics that have no direct application and would give a thorough training in the more useful parts of the subject, using as illustrations problems from various walks in life; it may be problems such as arise in the career the student has chosen, it may be problems with a close resemblance to those of his career and appropriate to be dealt with by the same mathematical tools. Prof. Maclean believes that in this way he will replace the deadening teaching of the past by teaching that will make the mind alert, and the mathematical knowledge available on every occasion—he will substitute an effective education for a nugatory one. Although the universities of Great Britain show no comparable development, our schools have, during the present century, gone through the change advocated, by the scrapping of the branches of mathematics that lead nowhere and by aiming at contact with reality in the retained branches. The effect of this change on the pupils has been remarkable. The old style teaching was understood by about five per cent of the pupils, and the idea prevailed that mathematics was a special gift. On the new lines, every pupil understands and readily applies his knowledge to his own problems. We wish all success to Prof. Maclean, who is a pioneer for the university of the reform that has proved of such value in the school.

Calendar of Patent Records.

August 3, 1822.—Machine saws for felling trees have not found great favour, but many have been invented. An early example was the subject of Mouret's patent granted for five years in France on Aug. 3, 1822. The saw is mounted on rollers and is moved to and fro by manually operated gear, being guided in a frame so as to have a slightly circular motion. The frame itself is also on rollers, and is caused to advance slowly towards the tree with each cut of the saw by means of weights and rope gearing.

August 3, 1832.—A 'bachelor' button which could be attached to the garment without sewing—a type that became very popular during the War—was patented by John Christopher of London on Aug. 3, 1832.

August 4, 1877.—The gas engine was established on a firm basis, and for the first time became a serious competitor of the steam engine as a prime mover, when Nikolaus Otto introduced the four-stroke engine which he patented in Germany on Aug. 4, 1877. Otto had been working at the problem for more than twenty years, and had already in 1867 achieved partial success with the Otto and Langen engine, but the new engine entirely superseded all others and monopolised the world's markets for many years. The improvement was very largely due to the re-introduction of Barnett's proposal to compress the charge of gas and air before ignition (cf. Calendar of Patent Records, April 18).

August 5, 1551.—An early reference to tin-plate manufacture and what appears to be the first instance of a German patent grant is given by Beck in his "Die Geschichte des Eisens", when he records that on Aug. 5, 1551, King Ferdinand granted to Freiherr Hanns von Ungnad of Steiermark the privilege to erect one or more mills for the manufacture and tinning of sheet-iron and to carry on the trade unhindered for a period of twenty years, "in Bedacht der ansehnlichen, nützlichen, beharrlichen, hocherspriesslichen, Dienste, so er sider Eingang unsrer landesfürstlichen und königlichen Regierung mit ungespartem, seinem Leib und Gut willig und unverdrossenlich bewiesen hat".

August 8, 1777.—The first patent for a milk churn was that granted on Aug. 8, 1777, to John Rastrick of Morpeth, the engineer. The churn is in the form of a barrel, with a central shaft having several sets of 'dashers' and rotated by means of an external handle. A ventilator is fixed upon the barrel.

August 9, 1913.—The possibility of the hydrogenation of coal to oils has been recognised for many years, and a great deal of experimental work has been carried out to arrive at a practicable process, but the problem was not solved until Bergius introduced his method of subjecting bituminous coal to the action of hydrogen at pressures of from 200 to 300 atmospheres and at temperatures of from 300° to 500° C., which he patented in Germany on Aug. 9, 1913. Though the technical difficulties, however, have been overcome, the cost of production remains at present too high to admit of the process being commercially successful in competition with mineral oil production.

August 10, 1874.—One of the pioneers of the modern aerial ropeway system of transportation was the German engineer Adolf Bleichert, who was mainly responsible for the development of the two-rope system in which there is a fixed carrying rope and a separate hauling rope, in contrast to that introduced in Great Britain in which a single endless moving rope to which the carriers are fixed is employed. Bleichert's first patent was granted in Saxony on Aug. 10, 1874.