

The author, here and elsewhere, keeps in close touch with the actual experimental conditions, and makes frequent reference to the historic controversies of the early days of long-distance signalling. This chapter is followed by an account of the author's investigation of the electrostatic field associated with a given current system. An interesting special case is worked out in detail, viz., the two-dimensional field produced by a current sheet flowing round an infinitely long cylinder, an impressed E.M.F. being localised in a generator.

In the treatment of induced currents which follows, Prof. Brillouin departs widely from the order of ideas now usually adopted. He confines the discussion to fixed circuits in a uniform non-magnetic medium, and takes as starting point Felici's experiments on the induction of currents in a secondary circuit, by making or breaking a given current in a primary. Proceeding in the old action-at-a-distance manner, he gets first a formula for the inductive action of an element of the primary circuit on an element of the secondary, and from this obtains the coefficient of mutual induction and the vector potential. Some cases of induction coefficients are worked out, and then follows an exhaustive and critical analysis of Kirchhoff's great memoir of 1857, in which the finite rate of propagation of electric effects along a wire was established.

Perhaps the most novel feature of the book, at least to an English reader, is the way in which the question of open circuits is approached. The author begins by adding to his vector potential a term which goes out on integrating round a closed path. This term is affected by an arbitrary constant which appears also in the complete electric force derived from the new vector potential. The value of this constant is then chosen so as to make the divergence of the electric force still equal to  $4\pi$  times the charge. This preserves what the author calls the "unity of the electric force," i.e., it makes the ponderomotive force on unit charge identical with the current-producing force which enters into Ohm's law. When we have reached this point we find that the new term in the vector potential has given us Maxwell's displacement current. It is then shown that its identification as a true current makes all currents closed, and is justified by its electromagnetic effects. The magnetic force is then introduced "pour la commodité de langage," as the vector the time-rate of which is the curl of electric force; and such things as magnet-poles need not exist at all.

To readers brought up on Maxwell and Heaviside this electrostatic method of arriving at things will come as a sharp disturbance to the "normal piling" of their electrical ideas. A similar disturbance would be produced in the theory itself by the introduction of a little iron into its system. We shall probably understand the reason for the adoption of this procedure if we remember that Prof. Brillouin wrote when "l'affaire Crémieu" was at its height, and before Pender crossed the Atlantic to see what the matter was. An exposition which linked Maxwell's

views to the earlier theories was specially natural at that time, in view of the doubts suggested touching relations which had come to be regarded as the "solid ground of Nature." If a revision of belief had been shown to be necessary, some such harking-back to earlier positions as is displayed in the present book would have become essential.

The concluding section of the lectures is occupied with a discussion of the problems of the Hertz oscillator and of the oscillations proper to spherical and spheroidal conductors. A full account is given of the recent work of Prof. Pearson and Miss Lee on the field of the Hertzian doublet as modified by the damping of the oscillations. In the discussion of the spheroid the author supplements the work of Abraham and Maclaurin, specially in the direction of numerical evaluation of the functions involved.

W. B. M.

#### MILK IN RELATION TO DISEASE.

*Bacteriology of Milk.* By Harold Swithinbank, of the Bacteriological Research Laboratory, Denham, and George Newman, M.D., D.P.H., Medical Officer of Health of the Metropolitan Borough of Finsbury, and formerly Demonstrator of Bacteriology in King's College, London. With special chapters also by Dr. Newman on the Spread of Disease by Milk and the Control of the Milk Supply. Pp. xx+605; illustrated. (London: John Murray, 1903.) Price 25s. net.

THE public is beginning to recognise the importance of milk and its products from the dietetic and hygienic point of view, and public authorities are becoming alive to the necessity for safeguarding the milk supply from adulteration, from the addition of preservatives, and from contamination with filth and the germs of disease. The appearance of this work, a large volume of 600 pages, is therefore opportune. It is a treatise on milk in its relation to disease rather than, as its title implies, an account of the general bacteriology of milk, for while such subjects as the souring of milk and the various fermentations it undergoes are dealt with in 55 pages, tuberculosis in relation to milk, epidemics of disease due to infected milk, the legal enactments regulating milk supply, &c., occupy some 350 pages.

As a general criticism, in the reviewer's opinion some of the matter introduced might without detriment have been omitted, thereby giving more space to certain subjects that at present receive somewhat scant treatment. Thus an attempt has been made to deal generally with bacteriological technique, the preparation of culture media, and examination of water and air, instead of limiting the matter in these directions to that special to the subject. The pages on the agglutination reaction, on preventive inoculation in enteric fever, and on the bacteriological diagnosis of diphtheria seem to be quite unnecessary. The chapter on the description of species of milk bacteria, occupying some 60 pages, also gives for the majority

of species so few details that in its present form it is of little value. This may be the fault of the subject rather than of the authors, but had an attempt been made to give a key-index to the species and their recognition, this would have been of much use. With these reservations, the authors are to be congratulated on having produced a work which must for some time to come remain the standard one on the subject.

The tubercle and acid-fast bacilli met with in milk and the biology of the tubercle bacillus are fully and adequately treated, and a number of coloured and other illustrations of cultures and colonies are given which will be of the greatest service to those who are unable to consult original papers. As regards the relation of bovine and human tuberculosis, a judicial and judicious summary is given, and the authors express the provisional opinion "that tuberculosis in all animals is generally one and the same disease, but that it differs in various ways in different animals and according to the strain and virulence of the infecting bacillus. That human tuberculosis can be transmitted in certain circumstances to animals we do not doubt. There is also *prima facie* evidence to show that the reverse proposition is true, namely, that under certain conditions bovine tuberculosis is transmissible to man. We therefore look upon the two diseases as different species or varieties of one and the same generic disease and intercommunicable. Whilst we hold this view in respect to the communicability of tubercle, we do not for one moment suppose that its transmission through milk is very frequent or very widespread. The great field of infection in tuberculosis is from animal to animal, and from man to man, and cross-infection is probably less common than is generally supposed."

This opinion practically coincides with that expressed in the recent report of the Royal Commission on Tuberculosis. Dealing with outbreaks of epidemic disease due to an infected milk supply, scarlatina, enteric fever, diphtheria, epidemic diarrhoea, cholera, &c., receive attention, and the details of many of the principal outbreaks are summarised. As regards the celebrated Hendon outbreak of scarlatina, the whole of the facts is stated, and not a portion only, as is generally the case, and the authors conclude, "we are of opinion that the exact origin of the London epidemic at that time has not yet been, and now probably never will be, demonstrated." It is to be hoped that future writers on the subject will note this.

The last portion of the book deals with the control of the milk supply (*a*) by the State, and (*b*) by private enterprise, with useful appendices on legal enactments and model regulations for dairies, &c. The summary on milk legislation in the various countries of the world is especially to be commended. Tuberculin is touched upon, and the old and the new tuberculins are described, but no mention is made that it is the *old* tuberculin which is employed for cattle testing. The sections dealing with pasteurised and sterilised milk are very brief, and might well be expanded in a future edition, while condensed milks seem to be unnoticed. The book is well produced and illustrated, but the index might with advantage be fuller.

R. T. HEWLETT.

## OUR BOOKSHELF.

*Handbook to the Natural History of Cambridgeshire.*  
Edited by J. E. Marr and A. E. Shipley. Pp. viii + 260: (Cambridge: University Press, 1904.) Price 4s. net.

THE little volume before us affords an excellent example of the thorough-going and careful manner in which every detail connected with the late meeting of the British Association at Cambridge was thought out and worked out by the responsible executive. As a matter of fact, the volume in question is likely to be much more than a mere ephemeral production, and will probably take its place as one of the standard text-books in the scientific teaching of the university; for it will scarcely be disputed that a thorough knowledge of the natural history of the district in which the student resides is one of the very best aids towards attaining a comprehensive grasp of biology and geology in general. The term natural history, it should be mentioned, is employed in this work in its very widest and most extensive sense, embracing not only zoology and botany, but likewise geology and palæontology; while the scope of the undertaking is still further increased by an excellent chapter on prehistoric archaeology.

For the planning and supervision of a work of this nature no better editors could possibly have been found than Messrs. Marr and Shipley, the one gentleman being an eminent authority on geology in general, and that of the district in particular, while the other is no less distinguished as a biologist. Dr. Marr, in collaboration with Mr. Fearnside, has contributed the introductory chapter on physiography, but Mr. Shipley has contented himself with purely editorial functions. For the other chapters of the work the editors have been fortunate in securing the (gratuitous) services of a number of specialists, at least two of whom happened to be engaged on the natural history of Cambridgeshire for the "Victoria County History," and were permitted by the council of that undertaking to make use of their labours for the benefit of the volume before us. Hitherto no complete lists of the fauna of Cambridgeshire appear to have been published, and Mr. H. H. Evans's account of the birds of the county may be cited as an excellent example of the manner in which such local faunas should be described. It was somewhat unfortunate that in the account of the vertebrate palæontology of the county the introduction of a personal element was unavoidable; but the proposal contained therein, to name a species after the well known palæontologist whose work is criticised, may be taken as an indication of the absence of any trace of ill-feeling on the part of the writer.

Both editors and authors are to be congratulated on the production of such an excellent and comprehensive local "natural history" in such a small compass, the permanent value of the work being largely increased by the beautifully coloured geological map of the county.

R. L.

*Theorie der Elektrizität und des Magnetismus.* By Dr. I. Classen. Band i. Electrostatik und Electromagnetismus. Pp. x + 184. (Leipzig: G. J. Göschen, 1903.)

THE conventional text-book of electricity starts with the supposition that the forces exhibited by electrified bodies can be attributed to a something called electricity which resides on material bodies. Quantitative laws are developed, and we are led up to the Faraday-Maxwell conception of the medium as the real seat of electrical action.

Prof. Classen, like many others, finds this method unsatisfactory. The first view presented is too narrow; its arbitrary character cannot always be realised, the