less impassable walls of chance within a much more circumscribed area, which we may call the practical limit of migration—that is, a limit beyond which any given percentage of units which we like to select do not generally pass. Lastly I tried to apply this reasoning to the important particular case of the immigration of mosquitoes into an area in which their propagation has been arrested by drainage and other suitable means. My conclusions are:

1. The mosquito-density will always be reduced, not only within the area of operations, but to a distance equal to the ideal limit of migration beyond it.

2. On the boundary of operations the mosquito-density should always be reduced to about one half the normal density.

3. The curve of density will rise rapidly outside the boundary and will fall rapidly inside it.

4. As immigration into an area of operations must always be at the expense of the mosquito population immediately outside it, the average density of the whole area affected by the operations must be the same as if no immigration at all has taken place.

5. As a general rule for practical purposes, if the area of operations be of any considerable size, immigration will not very materially affect the result.

In conclusion, it must be repeated that the whole subject of mosquito-reduction can not be scientifically examined without mathematical analysis. The subject is really a part of the mathematical theory of migration—a theory which, so far as I know, has not yet been discussed. It is not possible to make satisfactory experiments on the influx, efflux and varying density of mosquitoes without such an analysis—and one, I may add, far more minute than has been attempted here. The subject has suffered much at the hands of those who have attempted ill-devised experiments without adequate preliminary consideration, and whose opinions or results have seriously impeded the obviously useful and practical sanitary policy referred to. The statement, so frequently made, that local anti-propagation measures must always be useless, owing to immigration from outside, is equivalent to saying that the population of the United States would remain the same, even if the birth rate were to be reduced to zero. In a recent experiment at Mian Mir in India the astounding result was obtained that the mosquito-density was, if anything, increased by the anti-propagation measures—which is equivalent to saying that the population of the United States would be increased by the abolition of the birth rate. It is to be hoped that if such experiments are to be repeated they will be conducted by observers who have considered the subject. In the meantime, I for one must continue to believe the somewhat self-evident theory that anti-propagation measures must always reduce the mosquito density—even if the results at Havana, Ismailia, Klang, Port Swettenham and other places are not accepted as irrefragable experimental proof of it.

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SCIENTIFIC BOOKS.

A Text-Book of Physics: Heat. By J. H. POYNTING and J. J. THOMSON. London, Charles Griffin & Co. 1904. Pp. xvi + 354.

This text-book is the third of a series on general physics by the two distinguished scholars of Birmingham University and of Cambridge. The other two volumes are 'Properties of Matter,' which has already reached a second edition, and 'Sound,' the third edition of which has recently appeared. Two more volumes, on 'Light' and 'On Magnetism and Electricity,' are in preparation. As Professor Poynting says in the preface to

the volume before us, 'The text-book is intended chiefly for the use of students who lay most stress on the study of the experimental part of physics, and who have not yet reached the stage at which the reading of advanced treatises on special subjects is desirable.' With this end in view special attention is given the description of the fundamental experiments and special emphasis is laid upon the various assumptions, and the conditions under which the different theories hold.

It is of interest to note the order of arrangement of the matter in a text-book written by men so well known as teachers as well as investigators. There are in all twenty chapters, and their contents may be outlined as follows: Discussion of temperature; expansion with rise of temperature; quantity of heat, conductivity; conservation of energy; the kinetic theory of matter; change of state; radiation and absorption; thermodynamics, radiation.

A better order for the presentation of the subject of heat could hardly be imagined; and as one reads the chapters it is only at rare intervals that one feels called upon to offer any criticisms or to make any comments which are not most favorable. It may not be amiss to mention as being worthy of special praise the treatment of such subjects as the kinetic theory of matter, radiation, the porous plug experiment, the discussion of various phenomena in meteorology, the spheroidal state, and the theory of the radiometer. The most valuable feature of the book is undoubtedly the exact statement of the various theories and their limitations. Thus, in speaking of the radiometer, the authors say: "The theory is altogether beyond our scope, but the following account of what occurs may give some idea of the action. It is to be remembered that it is an account and not an explanation." Various sentences like this may be found throughout the book, and any student must be impressed with the great care taken to give a true account of both experiments and theory. There is one criticism, rather general in its nature, which may be passed upon the whole book, and that is that too much attention is given experiments and observations of former days at the expense of more modern work. It does not seem altogether advisable to discuss so fully experiments which were incomplete or mathematical laws which have been shown to represent the truth imperfectly. This is specially marked in the chapter on radiation. Again, in the description of certain forms of instruments, care is not taken to explain certain essential features in their accurate use, as, for instance, the Bunsen ice calorimeter. It would have been well, further, in discussing the difficulties of calorimetry to say a few words concerning the instrument perfected by Waterman. In the chapters dealing with the specific heat of water and the mechanical equivalent of heat good, bad and indifferent experiments are all described together, and a student is not told which are the best. If so many experiments and observations are to be described, it certainly would be best for a student to be told which are designed with the greatest care and which are the most trustworthy.

These slight criticisms are not meant in any way to reflect upon the excellent character of the book. As a text-book it stands by itself and should be put in the hands of every student of physics early in his course.

J. S. Ames.

Minnesota Plant Diseases. By E. M. Freeman, Ph.D., Assistant Professor of Botany, University of Minnesota. Report of the Survey, Botanical Series, V. St. Paul, Minnesota, July 31, 1905. Pp. xxii + 432. 8vo.

From time to time, it has been the pleasant task of the writer to notice the publication of the Botanical Survey of Minnesota, and to comment upon the thoroughly satisfactory style of publication adopted by the director, Professor Conway Macmillan, of the University of Minnesota. The volume now before us fully maintains the high standard set by the previous publications in this series. In its paper, type, illustrations and binding, this volume leaves nothing to be desired. As one turns over the pages, he is struck by the uniformly high quality of the illustrations, whether they are cuts from line drawings, or half-tones from photographs. They are all