THE KINETIC THEORY REVIVED.

The Dynamical Theory of Gases. By J. H. Jeans. Second edition. Pp. vii + 436. (Cambridge: At the University Press, 1916.) Price 16s. net.

MORE than eleven years have elapsed since the first edition of this work was reviewed in NATURE (April 27, 1905). Most of the pioneers of the attempted rigorous mathematical theory have passed away, and the attempt to reconcile Boltzmann's minimum theorem with the properties of an aggregate of perfectly reversible units may be said to have been abandoned. On the other hand, the recently developed quantum hypothesis has, to some extent, had the opposite effect of leading us to believe that something more than the equations of reversible dynamics is needed to account for the phenomena of Nature. Equipartition may be characteristic of molecular systems, but the celestial universe shows no tendency towards Maxwell's law, and would probably refuse to obey it even if started according to this distribution.

The plan which Prof. Jeans now adopts in his book is probably the best one in the circumstances. The kinetic theory cannot be proved mathematically, neither can the data determined from a *calculable* mathematical theory be made to serve as more than approximations to the results of experiments. Thus arises a school of slipshod students of physics, who, when they cannot prove a result mathematically, state that it "has been shown experimentally," and if they cannot get their experiments to verify they state that it "may be proved" (from theory). This danger is largely obviated by the division of the earlier chapters into four sections, entitled "Mathematical Theory of a Gas in a Steady State," "Physical Properties of a Gas in a Steady State," "Mathematical Theory of a Gas not in a Steady State," "Physical Phenomena of a Gas not in a Steady State."

Among the miscellaneous applications it is interesting to note Prof. Jeans's remarks on the rate of escape of gases from planetary atmospheres. It will be remembered that the late Dr. Johnstone Stoney attempted to account for the loss of gases by the motion of the molecules which describe hyperbolic orbits under the attraction of the primary; and by assuming the absence of a particular gas from a particular member of the system he deduced the absence of other gases from other systems. It was, however, subsequently shown that, under the assumptions made by Dr. Stoney, the gases in question would not escape, and Dr. Stoney advanced the opinion that the methods of the kinetic theory on which his own investigations were based were inapplicable to the problem to which he had applied them. According to Prof. Jeans's views, hydrogen does not at present escape, but it did so when the earth was at a far higher temperature than at present. On the other hand, the brief discussion on our existing knowledge regarding the upper and lower regions of the atmosphere will help to reconcile theory with experiment.

The book thus contains as much information as an ordinary physics honours student can profitably study. But, of course, this is nothing like the whole of the kinetic theory, whether studied mathematically or experimentally.

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MENDELISM ON THE FARM.

A Manual of Mendelism. By Prof. James Wilson. Pp. 152. (London: A. and C. Black, Ltd., 1916.) Price 2s. 6d. net

PROF. WILSON has prepared an exposition of Mendelism which will be of special interest to stock-breeders and serious students of agriculture. It is a model of clearness and directness, and bears the marks of the teacher as well as of the investigator. After explaining Mendel's experiments, his rule and his theory, the author passes to a discussion of various disturbing causes which account for abnormal distributions of characters. Thus there are cases in which the effects of the individual factors cannot be identified separately; cases of the suppression of the effect of one factor by that of another; cases of incomplete or absent dominance; cases where a factor is believed to combine indifferently with more than one other; cases where two or more factors seem to be linked together so that they are handed on from generation to generation as one; and cases in which two different factors produce a similar effect.

These are some of the reasons for results which are not typically Mendelian, and they might have been added to. Thus it has been convincingly shown by Morgan and others that environmental and developmental influences may have a profound effect on the outcome of Mendelian factor-differences. Prof. Wilson goes on to illustrate the improvements which have rewarded careful experimentation, *e.g.* as regards yield of wheat and of milk. That Mendelian formulæ can be used towards an increased production of material wealth has been proved by the results of workers like Nilsson-Ehle and Pearl, and these are but indications of what might be achieved. The average yield of wheat in Britain is about 32 bushels to the acre; it might be raised to 40 or even 50 bushels. "For every day by which the life of a variety of wheat is shortened between seed-time and harvest, the wheat-growing area in Canada reaches fifty or sixty miles farther northwards."

The work done in Denmark shows how the wealth of Britain, so far as it proceeds from dairy cattle, might be very nearly doubled. Those who wish to know how such exceedingly desirable results can be attained will be well advised if they study a book like Prof. Wilson's. It will show them how they may act with circumspection and foresight. The book would have been the better for pictures and its terse style is perhaps a trifle severe, but it is a book for the times, competently and carefully executed, which those whom it especially concerns should run to read.