

generation, and the stimulus they gave to the progress of agriculture were out of all proportion to the value of the knowledge or even of the ideas they contributed to the subject. Davy gave dignity to the study of agricultural science; where Davy had laboured no man in future need be ashamed to work. Two articles follow on fruit farming, by Mr. Charles Whitehead, and on vegetable farming, by Mr. James Udale. Both are sound enough, but they are rather jejune performances for the *Journal* of the Royal Agricultural Society, since from the inevitable limitations of space they are too lacking in detail to be of service to anyone but the amateur. When it comes to reproducing pictures of the wireworm from the Society's text-book of agriculture, instructions for making Bordeaux mixture, and similar elementary matters, the farmer reader may well wonder where the editor's blue pencil has been lying. Mr. Dudley Clarke writes on a burning question of the day, the cost of labourers' cottages, and gives a number of sensible plans, bringing out the cost of a brick and tile cottage with three bedrooms at about 150*l.*, including the land and the cost of a well.

Mr. A. D. Hall writes on the agricultural experiments of Mr. James Mason, the well-known founder of the firm of Mason and Barry, who spent his later leisure in attempting to apply science to agriculture with some success, while the rest of the volume is occupied with the last Park Royal show, with reports of the experiments in progress at the Woburn Farm, and with other society matters.

Mediaeval Lore from Bartholomew Anglicus. By Robert Steele; with preface by William Morris. Pp. xv+195. (London: Alexander Moring, Ltd., 1905.) Price 1*s.* 6*d.* net.

THIS beautiful addition to the "King's Classics," of which Prof. Gollancz is the general editor, is likely to prove of interest to students of science. Written by an English Franciscan, probably before 1260, to explain the allusions to natural objects met with in the Scriptures and elsewhere, it is really an account of the properties of things in general so far as they were understood by an educated writer of the Middle Ages. After studying the quaint and pleasant accounts of mediæval science, medicine, geography, and natural history which the book contains, the student will begin to realise that during the Middle Ages science was not stagnant, but, by gradual development, was making possible the rapid growth of scientific knowledge characteristic of the nineteenth century. The reprint deserves to be read widely.

Ergebnisse und Probleme der Zeugungs- und Vererbungslehre. By Prof. Oscar Hertwig. Pp. 31. (Jena: G. Fischer, 1905.) Price 1 mark.

PROF. OSCAR HERTWIG is well known as a pioneer in the researches on fertilisation. In 1875 he made the important discovery that the essential fact in the process lay in the fusion of a single male with a female cell, and he also saw and recognised the fusion of the nuclei. It was fitting that at the congress held at St. Louis last year he should choose this subject as the text of his lecture. The reprint forms a clear statement of the chief details of fertilisation, and also indicates some of the theoretical conclusions towards which modern cytology is tending. The sketch of the so-called "reduction divisions" is specially good, and the author shows how clear a light they throw on the modern experimental results obtained from the study of heredity. The lecture will be welcomed by all who are interested in these and kindred questions, and those who know Prof. Hertwig's writings will not be surprised to find that if the treatment is of necessity brief, it is masterly of its kind.

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LETTERS TO THE EDITOR.

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The Dynamical Theory of Gases.

IN Mr. Jean's valuable work upon this subject he attacks the celebrated difficulty of reconciling the "law of equipartition of energy" with what is known respecting the specific heats of gases. Considering a gas the molecules of which radiate into empty space, he shows that in an approximately steady state the energy of vibrational modes may bear a negligible ratio to that of translational and rotational modes.

I have myself speculated in this direction; but it seems that the difficulty revives when we consider a gas, not radiating into empty space, but bounded by a perfectly reflecting enclosure. There is then nothing of the nature of dissipation; and, indeed, the only effect of the appeal to the æther is to bring in an infinitude of new modes of vibration, each of which, according to the law, should have its full share of the total energy. I cannot give the reference, but I believe that this view of the matter was somewhere expressed, or hinted, by Maxwell.

We know that the energy of ætherial vibrations, corresponding to a given volume and temperature, is not infinite or even proportional to the temperature. For some reason the higher modes fail to assert themselves.¹ A full comprehension here would probably carry with it a solution of the specific heat difficulty.

RAYLEIGH.

The Physical Cause of the Earth's Rigidity.

SINCE publishing the paper in the *Astronomische Nachrichten* (No. 3992), the investigations there outlined have been considerably extended, and lead to some remarkable results. My only purpose in this letter is to direct attention more particularly to the physical cause of the earth's rigidity. This seems to have remained rather obscure, and I am not aware that any definite theory has been adopted to account for the remarkable fact established by the researches of Lord Kelvin and Prof. G. H. Darwin.

It was pointed out in the *Astronomische Nachrichten* (3992) that the physical cause of the earth's high effective rigidity is to be found in the great pressure existing throughout the interior of our globe. This may be made somewhat more obvious by remembering that in any concentric spherical surface the resistance of the enclosed nucleus must be just equal to the pressure of the surrounding shells resting upon it, and thus the strain upon the matter of the globe increases towards the centre according to the same law as the curve of pressure given in the *Astronomische Nachrichten* (3992). This pressure is sustained by the increasing density and rising temperature of the matter in the earth's interior, which is thus under an inconceivable strain, far surpassing the strength of any known substance. As the matter is above the critical temperature of every element, it is essentially a gas reduced by pressure to a hardness greater than that of steel, and with an elasticity and rigidity infinitely near to perfection. The result is that the explosive strain upon the matter of our globe from within, which is everywhere just equal to the pressure sustained by the enclosed nucleus, renders the interior matter more rigid than any known substance; and even the outer layers, which are but slightly compressed, yield so little under the action of external forces that the globe as a whole is more rigid than steel, as Lord Kelvin and Prof. G. H. Darwin found from their profound researches on the long-period tides of the ocean.

It was these considerations which led to the conclusion that all the heavenly bodies of considerable mass when condensed to moderate bulk have nuclei of great effective rigidity, and experience no sensible circulation at great depths.

T. J. J. SEE.

U.S. Naval Observatory, Mare Island, Cal., March 20.

¹ Compare "Remarks upon the Law of Complete Radiation" (*Phil Mag.*, xlix. p. 539, 1900).