

LETTERS TO THE EDITOR.

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Prof. Boltzmann and the Kinetic Theory of Gases.

IN the discussion which followed the communication of my Report on Thermodynamics to the British Association at Oxford this year, Prof. Boltzmann made some remarks which appear to have been interpreted in a different light to what he doubtless intended. In the absence of any shorthand writer's verbatim report of the discussion, it is of course impossible to recall his exact words, but I feel sure that Prof. Boltzmann will be much astonished to learn that his statements are now widely circulated and quoted as being an authoritative admission that the Kinetic Theory of Gases is nothing more than a purely mathematical investigation, the results of which are not in accord with physical phenomena; in short, a mere useless mathematical plaything.

Is it likely that such an able physicist would have devoted so many years to the development of the theory, and would continue to work at it now if he regarded it in that light? Having had several conversations with him, both during and after the British Association meeting, I gather that his views are not nearly so pessimistic as the opponents of the kinetic theory would wish to maintain.

The statements were made in reply to a question as to how far the ratios of the specific heats of gases as given by theory accorded with the results of experiment. What I understood Prof. Boltzmann to imply was that his investigations treated the matter purely from a mathematical standpoint, but that the values he obtained by regarding the molecules of a gas as rigid bodies, viz. 1.6 for smooth spheres, 1.4 for smooth solids of revolution, and 1.3 for solids of any other form, accorded on the whole *very fairly* with the results of experiment. In that respect the kinetic theory stands on exactly the same footing as any other theory of mathematical physics. The evidence in favour of the fundamental assumptions of any theory necessarily rests on the agreement or want of agreement of the deductions with experience after due allowance is made for the fact that the conditions imposed by the mathematical difficulties of the investigation necessarily differ from those occurring in nature. I need only refer to Prof. Boltzmann's paper, "Ueber die Natur der Gasmoleküle" (*Sitzungsberichte der Wiener Akademie*, lxxiv. ii. 1876), for a more detailed account of his views on the question of the specific heats.

The objection which has been regarded by some as most antagonistic to the kinetic theory is that it does not afford an explanation of the spectra of gases. But is this duty required of it? If the luminosity of gases were due to vibrations of the atoms in the molecules, certainly there *would* be a difficulty about regarding the molecules as rigid bodies; but then such a hypothesis would preclude a gas whose molecules were monatomic from having any optical properties whatever. To my mind, the electromagnetic theory of light entirely relieves the kinetic theory from the burden which has been imposed on it by its opponents, since if (for example) we regard the molecules of a gas as perfectly conducting hard spheres, spheroids, or other bodies moving about in a dielectric "vacuum" (*i.e.* space devoid of ordinary matter), we shall be able to account for the spectra by means of electromagnetic oscillations determined by surface harmonics of different orders without interfering with the assumptions required for explaining the specific heats of gases. There are, however, other questions on which I should be glad to see a continuation of the brilliant discussion which had to be curtailed from want of time at Oxford. G. H. BRYAN.

Peterhouse, Cambridge, October 23,

Instinctive Attitudes.

MY attention has been called to Mr. H. M. Stanley's remarks on instinctive attitudes in NATURE of Oct. 18. I have been for some years studying children's attitudes and expressions from the evolution point of view; and have from time to time taken photographs as opportunity presented itself. I have now a considerable number which I hope to publish in that connection.

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One of the series accompanies this, and bears on Mr. Stanley's remarks. It was taken in May last, representing my youngest child, then ten months old. She never crawled, but always progressed on all-fours; and this photograph, taken instantaneously, shows her mode of travel to and fro on the garden path. The interesting thing about it is this: that the gait is front and back legs on opposite sides, like a dog or a cat, not on the same side, like a camel—a result which the evolutionist would have predicted; though of course we show a relic of the same habit in walking, by swinging the arm on the opposite, and not on the same, side as the leg. In this photograph, too, the heel and toe action of the hind limbs is instructive.

One of my children, in addition to the ordinary crawl, used to progress in a sort of three-legged fashion—it used the left hand



and the right foot for the forward step, rested itself on the shank of the left leg tucked under its body, and this it used as a foot to bring forward its body for the next step. Sometimes this developed into a three step mode of progression.

The bandaging, swaddling, carrying and wheeling about, which the civilised infant has suffered for many generations, no doubt partly accounts for the rarity of the quadrupedal mode of progression, by having hindered development of muscularity. The quadrupedal mode of progression indicates greater strength than the ordinary knee-crawl. S. S. BUCKMAN.

Cheltenham, October 24.

James Parkinson, the Author of "Organic Remains of a Former World."

IN a paper on the subject of museums, which was read in 1891 before the meeting of an association, James Parkinson is thus spoken of without any subsequent qualification of the statement made:—

"Finally, a private lottery was arranged for its disposal (the Leverian Museum), and in 1785 the prize was drawn by James Parkinson, a dentist, who took not the least interest in natural history or in museums."

As the scientific world seems profoundly ignorant as to what were the scientific qualifications and professional position of James Parkinson, the following facts may be worth publishing in NATURE:—

James Parkinson, who resided at No. 1 Hoxton Square, was not a dentist, but a surgeon. In Johnston's Directory for 1817 his address is thus given: "Parkinson and Son, Surgeons, No. 1 Hoxton Square." He had also an address in the Kingsland Road. His death is thus recorded in the *Gentleman's Magazine* of December 1824: "December 21st, in Kingsland Road, James Parkinson, surgeon, late of Hoxton Square." There was a firm of dentists in London, whose address in Johnston's Directory was as follows:—"Parkinson and Kidman, surgeon-dentists, 1 Racquet Court, Fleet Street"; but they had evidently no professional connection with James Parkinson.

The following list of works, &c., by James Parkinson, published by H. D. Symonds, Paternoster Row, is given at the end of a little book by him, of which the title is "Dangerous Sports; a Tale addressed to Children," printed for H. D.