

of the theory of partial differential equations. This restriction renders necessary some originality of method in problems relating to fluid motion and to the equilibrium and motion of elastic solids. The book should prove very useful to teachers, by showing how much of these theories can be treated adequately by the aid of simple analysis. Perhaps the most remarkable piece of work, among those designed to make the theories of mathematical physics accessible to readers whose mathematical equipment is not very large, is the discussion of the equation of transverse vibrations of a stretched string; the writer founds the theory of this equation on a geometrical method, which was initiated by Riemann in his memoir on the propagation of plane sound waves of finite amplitude. The portion of the book dealing with deformable bodies contains, among other things, a very interesting account of *stress*; the notion of stress is introduced by means of a preliminary statement in regard to the observed character of the interactions between the smallest parts of bodies. Observation seems to be credited here with proving things which must, from the nature of the case, be remote inferences from observation. The subsequent deductive investigation is very well done. Viscosity in fluids receives a good deal of attention, and the divergences between the motions and resistances of perfect and of viscous fluids are illustrated by comparing the two solutions of the problem of the steady motion of a sphere through a fluid, regarded first as perfect and then as viscous, and by the contrast between the diffusion of vorticity in a viscous fluid and the permanence of vortex motion in a perfect fluid. Although it might be wished that the treatment of the fundamental theorem of rational hydrodynamics had been less summary, yet it will be felt that the student of theoretical physics owes a debt of gratitude to Dr. Voigt for his clear outline of the theories of fluid motion.

A. E. H. L.

ESSAYS ON BIRD-LIFE.

Birds and Man. By W. H. Hudson. Pp. 317. (London: Longmans, Green and Co., 1901.) Price 6s. net.

THE author of "The Naturalist in La Plata" is such a close and accurate observer of nature, and has such a rich store of anecdote upon which to draw, while his style is so fresh and invigorating, that a hearty welcome from the public is well-nigh sure to await all the efforts of his pen. In this little volume he has given us a delightful series of essays dealing with bird-life in England, in the course of which he dwells specially on the relations between bird and man as they exist in nature. Many of these essays have previously appeared in various serials, but a very considerable portion of the book, including the introductory chapter, is new.

Mr. Hudson has such an enthusiastic love for bird-life that, as he tells us in this introductory chapter, the sight of stuffed birds in a museum is positively painful to him. If this be so, an obvious and easy course lies before him, and it is unnecessary on his part to say that collections of this nature "help no one, and their effect is confusing and in many ways injurious to the mind, especially to the young." No one, of course, wishes to argue that stuffed birds are as good as living ones, but

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since the great majority of us have neither opportunity, time, patience nor money to devote to the observation of birds in their native haunts, we may surely be permitted, if we please, to study and admire their counterfeit presentments in a museum.

Perhaps the most interesting chapter in the book is the second, which bears the same title as the book itself. Here the author tries to imagine what birds think of man. At times, he thinks, they must be considerably puzzled, as when a blackbird is petted while on its nest by the owner of a garden, only to be shot at or stoned when it leaves the protected precincts.

"Birds" (says the author) "are able sometimes to discriminate between protectors and persecutors, but seldom very well, I should imagine; they do not view the face only, but the whole form, and our frequent change of dress must make it difficult for them to distinguish those they know and trust from strangers. Even a dog is occasionally at fault when his master, last seen in black and grey suit, reappears in straw hat and flannels."

Later on it is shown how birds clearly discriminate between dangerous and harmless mammals, the author giving us many interesting anecdotes derived from his Argentine experiences of the relations between birds and mammals in the wild state.

Several of the chapters—notably the one on the Dartford warbler—are devoted entirely to British birds, but in others the author takes a wider field. Among these latter the article on geese, with its description of the vast throngs of the Magellanic and upland species to be seen at certain seasons in Argentina, is of especial interest. It closes with a pathetic anecdote of a pair of these birds, which, on account of the female having a broken wing, started to *walk* the long journey from the pampas of La Plata to distant Patagonia.

In the two concluding chapters the author gives some supplementary notes on the birds of London, and describes his impressions on first visiting Selborne in 1896. In taking leave of this charming book we have two regrets—one that it is not longer, and the other that we have not space for a fuller notice. R. L.

OUR BOOK SHELF.

The Earth's Beginning. By Sir Robert S. Ball, LL.D., F.R.S. Pp. viii + 384. (London: Cassell and Co., Ltd., 1901.) Price 7s. 6d.

THIS is a popular account of the nebular hypothesis, based upon a course of lectures adapted to a juvenile audience, and it is, therefore, almost superfluous to remark that the subject is presented in simple language and that no great mental effort on the part of the reader is called for. The theme is one which furnishes splendid opportunities for the display of the powers of graphic description and illustration for which the author is so well known, and the book will doubtless succeed in extending the interest in this fascinating chapter of science.

From the demonstration of the existence of true nebulae, the reader is gradually led to the evidence that the sun and earth once existed in nebulous form, and thence to see how the present conditions of the solar system accord with the hypothesis. The difficulty presented by the anomalous revolutions of the satellites of Uranus and Neptune is got over ingeniously by supposing that in these cases the concordant stage of the evolutionary pro-