upon the production of artificial oxidases; of the nature and supposed functional importance of the catalases, etc. It would be scarcely possible in fact to enumerate in a brief notice all of the important points which are discussed and reviewed. The author has laid his fellow biologists, who may be concerned in understanding the nature of physiological oxidations, under a debt of gratitude for his able and exhaustive presentation of this difficult subject. We can only wish that with his own extensive first-hand knowledge of the facts he had attempted to winnow from the great mass of contradictory or divergent observations those that to him might seem to be entitled to at least provisional acceptance at the present time. The reader who is not a specialist in this line of work is somewhat at a loss to appreciate how the balance of evidence tends in regard to many of the disputed points.

W. H. Howell

The Evolution of Worlds. By Percival Lowell. Pp. xiii + 262; 12 plates and 56 text cuts. New York, The Macmillan Company. 1909. $2.50 net.

This work is written in the well-known attractive style of the author. It is interesting and will probably fascinate and charm many readers of popular science. Its charm, however, lies in the literary skill of the author, in the attractiveness with which the book is manufactured, in the heavy paper, its clear type and its beautiful illustrations. As a work of art the book is charming and valuable; as an exposition of scientific facts and theories it is exasperating.

The theme of the book is the evolution of the solar system, the process by which the planets came into existence, the phases through which the world has passed, and through which it is destined to pass. Ever since Laplace, in 1796, formulated and published the nebular hypothesis, the subject of the birth, growth and death of worlds has aroused great interest and has attracted many able investigators. For nearly one hundred years the beautiful and simple theory of Laplace was accepted in its entirety by scientific writers. During the last quarter of a century, however, much has been learned concerning the present condition of the solar system, and many facts have been developed which, while establishing the broad underlying idea of planetary evolution, can not be reconciled with the simple Laplacian hypothesis. Sir George Darwin accepted the main outlines of the nebular hypothesis and accounted for the discrepancies between theory and fact by the agency of tidal friction. But there are limits to the potency of tidal friction and even in its modified form the nebular hypothesis fails to account in a satisfactory manner for all the complicated details of the solar system.

Within comparatively recent years Chamberlin and Moulton have advanced what is called the "planetesimal" or "spiral" hypothesis. It explains many of the difficulties encountered by the Laplacian or nebular hypothesis and is undoubtedly the most satisfactory working theory yet advanced. Their first papers were published as early as 1900, since which date they have from time to time elaborated and developed their theory.

Now, Lowell's book, in its main features, is an exposition of the "planetesimal" theory, but an exposition with no reference to, or mention of, the work of Chamberlin or Moulton. It is like the play of Hamlet with Hamlet left out. Neither Chamberlin's nor Moulton's name appears in the index, nor, in a careful reading of the book, do we find any mention of them or of "planetesimal" or "spiral" hypothesis. This is not so strange as at first glance it might appear, for Professor Lowell has recently attacked the scientific value of the theory and the standing of its authors. In the *Atlantic Monthly* for August, 1909, Lowell refers, in a foot note, to Chamberlin and the planetesimal theory in the following words: "Astronomically he is unaware that what prompted his contention, the planetesimal hypothesis, is *mathematically unsound.*" The publication of the "Evolution of Worlds," with its nameless presentation of the planetesimal hypothesis, shows that while Lowell appreciates the fundamental correct-

ness of the theory and its value as a working hypothesis, he is unwilling to admit his former error and to give to true scientific workers the credit which justly belongs to them.

This obvious attempt at consistency on Professor Lowell's part is rather belated, for, as a rule, inconsistencies do not bother him. His books are full of them. He is so interested in marshaling his facts and proving the point at immediate issue, that he appears to forget that at some other time, in some other place, he has arrayed the same facts differently and by them proved the exact opposite. In order to prove, for example, that certain dark lines, which appear in his drawings of Venus, really exist and form permanent markings on this planet, Lowell argues, against the evidence of other investigators, that Venus is surrounded by a very thin atmosphere, "gauze of the most attenuated character"—that the brilliancy of the planet is due to this very thinness of atmosphere. In another chapter Lowell finds the brilliancy of Jupiter and Saturn mostly due to dense cloud forms in their atmospheres. On the one hand, Venus has no clouds because she is bright, while on the other hand, Jupiter and Saturn are bright because of clouds. Again these same markings, or pseudo-markings, on the disc of Venus have been variously described by Lowell in his different papers and books.

The book contains many loose statements of scientific facts and principles, and conclusions are drawn by special pleadings and by apt illustrations rather than by any course of logical reasoning. Yet with all this, and in spite of exaggerations and obvious attempts to create popular excitement, the book gives the general reader, in an attractive form, a more or less accurate conception of the latest ideas in regard to the evolution of our world. It is a pity that the work of such a brilliant writer should be marred by his all too evident faults.

CHAS. LANE POOR

Aerial Navigation of To-day; a Popular Account of the Evolution of Aeronautics. By CHARLES C. TURNER. Philadelphia, J. B. Lippincott Co. 1910. 8vo, pp. 327. Illustrated.

This book, which is one of the few of its kind in the English language, was brought out simultaneously last autumn in this country and in England. Its English author shows his predilection in ways hereafter mentioned, but, while he has made some long balloon voyages he modestly refrains from obtruding them upon the reader, unlike most writers of books upon aeronautics, who usually emphasize the particular subject with which they are most familiar. The reviewer himself is no exception, since in his "Conquest of the Air," a smaller contemporary work, of similar scope to the one under consideration, he gives first place to his own explorations in the element that man has conquered after so long a struggle. Mr. Turner begins with a history of ballooning and the principles involved in both spherical and dirigible balloons, mechanical flight being treated in the same way. There follows a chapter on the aerial ocean, which is a compilation of observations by European aerologists, often without context or sufficient explanation. The remaining chapters discuss the applications of aerial navigation and its possibilities, especially in warfare. Rather out of place is the concluding chapter on typical flying machines and dirigible balloons. "Useful tables," a useless glossary of English and French aeronautical terms and a very inadequate bibliography occupy the remainder of the 321 pages. The book is clearly written, profusely illustrated with pictures and diagrams and gives a good idea of the past history and present status of aeronautics. The sanguine prophecies of its future development recall the extravagant and unrealized hopes which were indulged in when the balloon was invented and render the adage, "never prophesy unless you know," a particularly safe one to follow as regards this new art.

No book of the kind can be entirely free from mistakes, but it would seem that the editor of *Aeronautics,* who read the MS. and, to quote the author, "than whom there is no