that 'the date given on the title page must be accepted as the date of publication.'

The fundamental point in this matter has really not been touched on by Dr. Allen or by myself. What we desire to ascertain is that date at which the discovery of a fact was announced, a formulation made, or a name given, and by whom. Until the description of the fact, the formulation, or the name, is printed, it has no fixity, and may be indefinitely altered. After it is printed the statement cannot be altered. Such a printed statement, wherever and whenever found, determines the question. Whether this be publication or not, the printed document will settle the question of priority, which is the point which we desire to have settled. It appears to me that no rules can set aside this proposition, however inconveniently it may sometimes, fortunately rarely, affect us. If we adopt (or rather follow, as it is already adopted) this view, we escape the complicated, and to my mind insoluble, questions as to publication, which may be brought up. It will probably settle, among other things, questions as to the inaccuracy of dates on 'the proceedings, memoirs, and other publica ons of scientific societies,' which Dr. Allen alleges, and of which I must say, I was quite unaware. E. D. COPE.

PHILADELPHIA, December 3, 1896.

SCIENTIFIC LITERATURE.

A History of the Warfare of Science with Theology in Christendom. By ANDREW DICKSON WHITE. 2 vols. Pp. xxiii, 415; xiii, 474. New York, D. Appleton & Company. 1896.

The title of this book describes its general character. Its range is indicated by the caption of its successive chapters. These embrace the development of Cosmology, Geography, Astronomy, Meteorology, Geology, Anthropology, Archæology, Ethnology, Chemistry, Medicine, Hygiene, Abnormal Psychology, Comparative Philosophy and Mythology, Political Economy, and Biblical Criticism and Theology. A large field for any one investigator to traverse! Yet such is the author's wealth of scholarship that he touches nothing without removing some obscurity, while important provinces are fairly flooded with light.

The book is of interest to the historian, the scientist, the theologian and the philosopher. But in estimating its value they must not forget the limits defined by the author. Dr. White does not, like Whewell, attempt to write a history of the sciences. Still less does he, like Harnack, essay a history of dogma. His theme, though more intensive, is less extensive. Dr. White concentrates attention upon the points at which the sciences, in the several crucial stages of their development, have come into conflict with the dogmas laid down in the creeds of Christendom. His book is a history of those collisions; and history being philosophy teaching by experience, Dr. White does not hesitate to apply its conclusions to the conditions of the present day. Nor is the author merely an historian of events in which he has no personal interest; on the contrary, the multitudinous victory of science over irrational dogmatism rejoices the lover of truth and evokes pæans unknown to the sober analytic historian. But this occasional triumph of the man over the historian does not detract from the historical value of the work. The greatest pains have been taken to secure accuracy; and the foot-notes show that innumerable libraries, both at home and abroad, have been consulted in the ascertainment and verification of the facts cited. Taking the text and notes together, the work may be fairly described as a kind of self-attesting encyclopædia; and as such it is likely to become, at least in the English-speaking world, the standard book of reference on the interesting subject with which it deals. Such books are not wont to be read through by many persons; but this one is likely to be often consulted by scientists who are interested in the early development of their specialty, by historians who deal with the progress of culture and civilization, and by theologians who care to see how the dogmatic apprehension of Christianity has been continuously modified by the inexorable pressure of the historical and natural sciences.

Dr. White makes it clear that the warfare of science is not waged against religion but against theology. The distinction between religion as a life and theology as a theory of that life is, from a logical standpoint, as clear as the distinction between digestion and physiology.

Yet the parallelism is not complete, as may be seen as soon as you look below the surface. Digestion is a material process which, being regulated by laws of physics and chemistry, is not in any way affected by the theories you form of its operation. But religion, as distinguished from theology, is a subjective experience, and, as such, it is liable to modification by any or all the elements entering into such experience—by thoughts and beliefs, therefore, as well as by aspirations and emotions. Furthermore, religion being so important and so pervasive a factor of our being, it tends to draw to itself, to attach, if not to assimilate and absorb, all associated phenomena of mind. There is no room here to expand these statements, yet they describe facts of the utmost importance in any treatment of religion and theology. It results therefrom that a plain Christian naturally supposes that his religious faith is assailed as often as science rectifies those erroneous views of the nature and operations of the material world which he happens to have bound up in the same parcel with his belief in a righteous God, who reveals Himself to the pure in spirit. This is the travail of religious experience. It is this which makes the real tragedy in the historical collisions between science and theology described in Dr. White's book.

But not only has religion the inborn habit of annexing other provinces to itself. There is a second cause of conflict with exact knowledge. It is not given either to the natural man or to the spiritual man, either to the worldling or to the Christian, but only to the investigator who explores and to the philosopher who reflects, to understand the incomplete and fragmentary character of human knowledge at every stage of its development. If Omniscience sees all things in a perfected infinite sphere, human beings get but glimpses of scattered points on the surface, and the scientist counts himself happy if he can but trace the infinitesimal arc of a minor circle. So again the philosopher, analyzing the origin, nature and limits of knowledge, soon discovers that at its best knowledge is a small (though happily an expanding) island surrounded by an infinite unknown. Both the scientist and philosopher, therefore, recognize not merely by general assent, but with genuine appreciation, the inherently provisional character and the progressive destiny of all theories and beliefs which at any given time may be held either by the generality of mankind or by its thinking vanguard. Knowledge is a continuous becoming; it has never attained—it is always on the way. Consequently the most assured dogmas of to-day may need modification and adaptation to the larger vision and deeper insight of to-morrow. But this is just what the uneducated man, whose mind is the victim of fixed and rigid abstractions, cannot understand. And as liberal culture has always been the possession of the few, one sees how the Christian world in general has so often been inhospitable to the progress of exact knowledge and how science has had to wage such a warfare against established modes of thought. Add to this that dogmatic theology, in previous generations at any rate, has, as a rule, set up the ignorant man's intoxication with completeness and finality as an ideal for its own scheme of thought, and you have all the conditions necessary for the explanation of that historic conflict which is the theme of Dr. White's instructive work.

Dr. White himself takes cognizance only of this latter force. Everywhere he makes it clear that dogmatic theology is at war with progressive science. If the explanation of this antagonism which has just been suggested be correct, it becomes clear that the foes of science are not merely the theologians with their fixed and final systems, but all the embattled hosts of ignorance who are indifferent to what is beyond their own purblindness. It is a general opposition of darkness to light. It would still exist were theology and theologians annihilated. There is one passage in Dr. White's work in which the author, if he does not rise to this more general point of view, at least shows that science in its progress has had to contend with unreason which was not the unreason of theologians. He says (Vol. I., p. 405):

"And it must here be noticed that this unreason was not all theological. The unreasoning heterodox when intrusted with irresponsible power can be as short-sighted and cruel as the unreasoning orthodox. Lavoisier, one of the best of our race, not only a great chemist, but

a true man, was sent to the scaffold by the Parisian mob, led by bigoted 'liberals' and atheists, with the sneer that the Republic had no need of *savants*. As to Priestley, who had devoted his life to science and to every good work among his fellow men, the Birmingham mob, favored by the Anglican clergymen who harangued them as 'fellow-churchmen,' wrecked his house, destroyed his library, philosophical instruments, and papers containing the results of long years of scientific research, drove him into exile, and would have murdered him if they could have laid their hands upon him."

With this quotation our notice of Dr. White's scholarly and fruitful work may appropriately come to a close. Let us only add that the first martyr to truth was the victim of a mob who hated to hear his teaching. The martyrdom of Socrates occurred four hundred years before the appearance of that unique personality who is the central figure of the dogmatic theology of Christendom.

J. G. SCHURMAN.

CORNELL UNIVERSITY.

Navigation and Nautical Astronomy. By F. C. STEBBING, M. A., Chaplain and Naval Instructor, R. N. Macmillan & Co., London and New York. 1896. 1 vol., 8vo, 328 pp. Price, $2.75.

This volume contains a complete course in all the necessary subjects of modern navigation. It may be recommended to those who have to acquire a knowledge of the theory and practice of the calculations that are required in the navigation of ships. By incorporating the necessary part of the Nautical Almanac for 1895 and referring the examples which are to be worked out to the data there tabulated, the author has overcome, in an original and effective manner, one of the chief obstacles which students of astronomical navigation universally experience in gaining a knowledge of the intelligent use of the data contained in the Almanac.

The book is also to be commended for the large number of useful examples and problems which accompany each division of the subject.

Where necessary, the methods are modernized so as to treat, for change of geographical position during the period of observation, the observations that may be made on board the swift moving vessels of the present day.

It has probably been overlooked that the directions given on page 54 for measuring the distance between two points on a Mercator chart will not generally apply. "The distance is found (nearly) by transferring the interval between the two positions to the graduated meridian, as nearly as possible opposite to the positions, *i. e.*, as much below the more southern as above the more northern; this space turned into minutes is the distance required." This method fails in most cases in which the line to be measured lies far from the middle of the chart, because when the interval is transferred to the graduated meridian one end or the other is likely to fall outside of the border.

Mention is not made of the generally applicable method of taking a small number of divisions of the graduated meridian, near the middle latitude of the line to be measured, between the points of a pair of dividers, and stepping this interval along the line to be measured.

In definition No. 8 it is stated that "A nautical mile is equal to the mean length of a minute of latitude, and is reckoned as 6080 feet." The actual mean length of a minute of latitude of the terrestrial spheroid computed upon the elements of the spheroid assigned by Bessel is 6076.23 feet, and upon the later and more perfect values assigned by Clarke, 6076.82 feet. The length of the nautical mile, or Admiralty knot, which is 6080 feet, corresponds more nearly to one-sixtieth part of the length of a degree of a great circle of a sphere whose surface is equal in area to the surface of the earth. This length is 6080.27 feet.

G. W. LITTLEHALES.

A-Birding on a Bronco. By FLORENCE A. MERRIAM. Houghton Mifflin & Co., Boston and New York. 16°, illustrated. Price, $1.25.

This volume is the result of the studies of two seasons in southern California. About sixty species of birds are spoken of, and with many we become quite well acquainted as we watch their nesting ways through the eyes of the sympathetic bird lover. It has also the novel feature of studying birds, not only with an opera