tion have become thoroughly familiar. Then, it is urged, the student will find it easier to appreciate the theoretical discussion which comes later, as this will merely take the line of explaining the reasons for facts of whose truth he is already convinced.

Both of these suggestions seem worthy of being tried out, and they may very likely have been already. If so, it is to be wished that some testimony as to the results might be presented in this department of the MONTHLY; as well as any other suggestions that have been found helpful in the teaching of this subject.

The last plan mentioned above, the postponement of the theoretical part of the work until the practical use of logarithms has been mastered, would prove most satisfactory if this practical part of the work could be introduced into the secondary school mathematics course, as would certainly seem desirable on many grounds. When this is done, the problem of the college teacher will be much simplified, and, what is of course of incomparably greater importance, the secondary school student will have the added knowledge and power that come from acquaintance with the practical use of so valuable a mathematical tool.

RECENT PUBLICATIONS.

REVIEWS.

HINDU SCIENCE.

Hindu Achievements in Exact Science, A Study in the History of Scientific Development. By B. K. SARKAR. Longmans, New York, 1918. 13 + 82 pp. Price, $1.00.

"The Astronomical Observatories of Jai Singh." By G. R. KAYE. *Archeological Survey of India,* New Imperial Series, Vol. 40. Calcutta, 1918, 8 + 154 pages + 26 plates and frontispiece photograph of Jai Singh. Price 15 rupees.

These two works are illustrative of two well-defined tendencies which have been existent for fifty years or more, in the discussion of Hindu science. The work of Sarkar is that of the enthusiast for all things Hindu; here we have the acceptance of practically all claims for the Hindu origin of different scientific ideas, with the general denial of foreign influence. In the work of Kaye we have the insistence upon the absolute dominance of foreign ideas in Hindu science, with the practical denial of any indigenous contribution.

Unfortunately *Hindu Achievements* is written by one who does not treat historical material critically; thus we have works of real value and works of no value cited as authorities, with a preponderance in favor of obsolete and even worthless works relating in one way and another to Hindu science. On the other hand Mr. Kaye is familiar with the modern authorities in the field of the history of science. This work of Jai Singh is a work of real merit but even it exhibits the tendency to depreciate the value of Hindu contributions which has characterized much of Mr. Kaye's work.

The denial of Hindu originality in science is paralleled by the denial on the part of certain writers of Babylonian, Egyptian, and even Arabic originality. This denial rests upon a fundamental misconception of the nature of science and scientific progress; it is of the same naïve nature as the common German view (before the war) that all discoveries in science of any value were German in origin.

To deny to Babylon, to Egypt, and to India, their part in the development of science and scientific thinking is to defy the testimony of the ancients,[1] supported by the discoveries of the modern authorities.[2] The efforts which have been made to ascribe to Greek influence the science of Egypt, of later Babylon, of India, and that of the Arabs do not add to the glory that was Greece.   How could the Babylonians of the golden age of Greece or the Hindus, a little later, have taken over the developments of Greek astronomy? This would only have been possible if they had arrived at a state of development in astronomy which would have enabled them properly to estimate and appreciate the work which was to be absorbed.   People in one stage of civilization do not borrow the science of another people in a higher state of civilization.   There has never been any question concerning the nature and origin of such feeble beginnings of science as are found among the American Indians.   With the Hindus and the Babylonians and the civilization of Europe in the time of Alexander the Great and up to 600 A. D., the problem is entirely different.   Here we have peoples who had reached approximately the same stage of development.   The admission that the Greek astronomy immediately affected the astronomical theories of India carries with it the implication that this science had attained somewhat the same level in India as in Greece.   Without serious questioning we may assume that a fundamental part of the science of Babylon and Egypt and India, developed during the times which we think of as Greek, was indigenous science.   Nor do we thereby detract from the real greatness of Greece.   The Hellenic civilization remains as an integral and vital part of all civilization, and not as something apart.

Recently Mr. Kaye has published an article[3] in which the denial of Hindu originality has reached the ultimate limit, including not only all Hindu astronomy, but even the sine function, the Hindu numerals, the value for π of 3.1416 and the solutions of indeterminate equations.   To justify this total repudiation it is necessary here to postulate the nature of the contents of Greek works which are lost. This is a new method in history, and not one to be commended.   Not a scintilla of real historical evidence is advanced to support the contentions.   Those who lack training in the weighing of historical evidence may take a new *theory* for *proof*, but there is a profound difference.

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[1] Hipparchus and Ptolemy, in Ptolemy's *Almagest*; Theon of Smyrna, and Diodorus Siculus; Herodotus, II, 109; Berossus, as given in fragments; Clemens of Alexandria; Pliny, *Hist. nat.*, VI, 122 and VII, 193; and numerous others.

[2] HEATH, *Aristarchos of Samos* (Oxford, 1913); BERTHELOT, *Les origines de l'alchimie* (Paris, 1885), Chap. III; BOLL, *Sphaera* (Leipzig, 1903), *p.* 461; CUMONT, *Astrology and Religion among the Greeks and Romans*; KUGLER, *Die babylonische Mondrechnung* (Freiburg, 1900), pp. 50–51, 200–211; Epping, *Astronomisches aus Babylon* (Freiburg, 1889), pp. 183–190.

[3] G. R. KAYE, "Influence grecque dans le développement des mathématiques hindoues," *Scientia*, Vol. 25 (Jan., 1919), pp. 1–14.

The work of Mr. Sarkar is in no sense scholarly. As a popular exposition it may be of interest particularly to Hindus, but it is distinctly unfortunate that so much is claimed which is easy to refute. This only results in the non-acceptance even of those claims which are justified.

Kaye's work shows the truly magnificent equipment of the observatories established by Jai Singh (1686–1743). Only among the Arabs would we find any buildings which could be compared with the Delhi, Jaipur, Ujjain, Benares, and Mathura structures. At Delhi quadrants, in the plane of the equator, with a radius of 49.5 feet, are graduated to minutes; the high masonry gnomon, 7.5 feet in width and 113.5 feet in length, rises above these quadrants to a height of about 68 feet, and its shadow on the quadrants gives the apparent solar time. Two complementary concave hemispheres of masonry work, diameter 27 feet, 5 inches, formed a part of the equipment; so also did two circular buildings with inside diameter of 49.1 feet, with 30 openings each 6° in width. Other masonry instruments and metal astrolabes and armillary spheres, in large part of Persian and Arabic workmanship, still survive from the instruments which were used in these observatories. A set of astronomical tables was prepared by Jai Singh, dedicated to the Emperor Muhammad Shah, being called Zij Muhammad Shahi; these tables follow closely the methods of Ulugh Beg. However, "polar longitudes" are given, as in the Surya Siddhanta, and it is more reasonable to suppose a Hindu source than a Moslem one, as Kaye does.

The wonderful ruins of these observatories of Jai Singh are a tribute to Hindu science, revealing an unusual power of appreciation of pure science whether or not they bear direct testimony to other positive achievements of the Hindus themselves.

<div align="right">Louis C. Karpinski.</div>

The Italian Universities and their Opportunities for Foreign Students. By Kenneth McKenzie. Roma, Tipografia Nazionale Bertero, 1919. 8vo. 16 pp.

This timely and very interesting pamphlet was written by Dr. McKenzie, professor of romance languages in the University of Illinois, but now Director of the Italian branch of the American University Union in Europe. The headings of the thirteen sections are as follows—'The Universities of Italy: their history; The universities of Italy: their present condition; Primary and secondary schools; Organization of the universities;—["The university year extends nominally from October 16 to July 31; but the instruction begins in November or even later, and ends by June 15. Examinations are as a rule given in two periods, beginning respectively October 16 and June 16"]—Registration and fees; University courses and degrees;—["The University courses are of four years in the case of the Faculties of Letters and Philosophy, Sciences and Law"]—Foreign students;—["Foreigners who have received a degree from a University of approved standing, and who can prove that they have studied all the subjects required for one of the regular degrees in Italy, are not obliged to study in residence or to take the examinations in the separate subjects, but may present themselves directly for the final examination for the degree which they desire. This does not apply, however, to the new degree mentioned below. The character of the final examination is . . . written dissertation and oral discussions."]—Requirements for the regular degrees; The new doctor's degree;—["On October 28, 1917, a new doctorate degree was established, equivalent in grade and in the amount of work required to the old four years' degrees, but not demanding their rigid selection of courses. This new degree is not professional in the sense of giving legal rights in connection with the practice of the professions in Italy, but is intended to encourage scientific attainment for the purpose of advancing knowledge and increasing