$10 per 1,000 quoted by one firm for medium weight and $14 per 1,000 for heavy weight driers. When it is considered that a large part of the material pressed under the old system, using blotters alone, required the use of two blotters between each specimen, it will be seen that a considerable saving is effected in the cost of the drying material as well as in the time required to handle and completely dry the material.

P. L. RICKER

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A NEW COLOR VARIETY OF THE NORWAY RAT

NORWAY rats with dilute coat color have recently been taken in the vicinity of the University of Pennsylvania. If we may judge from the fact that the nine individuals thus far found are all approximately alike and are distinctly different from the normal type, they probably represent a new Mendelian variety.

The coat is intermediate in color between that of the ordinary dark form and the albino and resembles that of the red-eyed guinea pig. In the guinea pig this color has been shown by Wright to be allelomorphic with albinism and with dilute. As in the guinea pig, the hair of the new rat seems to be without yellow pigment and is dilute black or brown ticked with white.

The eyes look black unless the light is very bright. When the light shines directly into them they appear pink. They are distinctly lighter than the eyes of Castle's red-eyed yellow rats, but darker than those of his pink-eyed yellows.

The new rats are now in the care of the Wistar Institute, where the endeavor is being made to increase the stock and to cross with the color varieties already known.

Data in regard to the distribution of the new form is being collected and will later be published.

The previously known Mendelian varieties in the rat are five: black, hooded, albino and Castle's two yellow varieties, red-eye and pink-eye. This new variety is a non-yellow dilute and may be called ruby-eye.

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SYLVESTER AND CAYLEY

UNDER the portrait with which the editor has adorned my article "Sylvester at Hopkins," in *The Johns Hopkins Alumni Magazine* of March, 1916, the designation is simply "James Sylvester."

This omits his real name, his family name, the name to which he was born; for his father was Mr. Abraham Joseph, his two sisters were the Misses Joseph. The name by which we know him he chose for himself, following the example of his eldest brother, who early in life established himself in America and assumed the name of Sylvester.

My laborious and critical friend, Professor G. A. Miller, of the University of Illinois, in his recent book "An Introduction to Mathematical Literature," commits the colossal error of representing Sylvester and Cayley as friends together at college, Cambridge chums, whereas Sylvester entered Cambridge in 1831 and Cayley was senior wrangler at Cambridge in 1842, more than a decade later. Sylvester had already in the session 1837–38 been appointed professor in London University College, and it was in London, but only after the lapse of nearly another decade, in fact in 1846, that Cayley met Sylvester.

GEORGE BRUCE HALSTED

GREELEY, COLO.

SCIENTIFIC BOOKS

Indian Mathematics. By G. R. KAYE. Calcutta & Simla, Thacker Spink & Co., 1915. Pp. 73.

Of all the British writers on the history of Indian mathematics at the present time, none is better known or more serious in his purpose than Mr. Kaye. A scholar by nature and, through his connection with the Indian service, placed in an environment which is conducive to the study of the original sources, few men have the opportunities which are his for bringing the mathematical learning of the East to the knowledge of the West.

This being the case, the reader might naturally expect to find in a publication with such a title as this an exhaustive and wellbalanced treatment of the general field of native Hindu mathematics. In this anticipation he will, however, be disappointed. Mr. Kaye's mind runs rather to monographs than to treatises, and these monographs are generally of real value to those who are less fortunately situated with respect to the sources of information. But in the present instance he has given us a monograph with a rather pretentious title which does not seem quite worthy of his undoubted powers. It is, of course, characterized by Mr. Kaye's prejudice against any claims of originality on the part of the Hindu scholars, but this feature is rather less obtrusive than in his other monographs, and in any case a reader can overlook a bias of this kind if he is presented with the evidence in such a fashion as to allow of its being weighed by himself. But the work is by no means an exhaustive presentation of Indian mathematics and it contains but little that is not already familiar to the students of history.

Mr. Kaye divides the subject into three historic periods: (1) the S'ulvasūtra period, extending to about A.D. 200; (2) the astronomical period, extending from about A.D. 400 to 600; (3) the Hindu mathematical period proper, extending from A.D. 600 to 1200, after which there was no native mathematics worth mentioning.

The word S'ulvasūtra means "the rules of the cord," and applies to certain verses treating of the construction of altars. The connection with the Egyptian "rope-stretchers" (harpedonaptæ) will occur to every one who has considered the history of ancient geometry, and, like so many parallels of this kind, is suggestive of the early intercourse between the East and the West. The dates of the S'ulvasūtras are uncertain, and the manuscripts show many variations due to different scribes, but we know to a certainty enough about them to render their study of interest in the history of mathematics. The Pythagorean theorem is stated with some generality, although there is nothing to show whether it was an independent product of India, or came from China, where it seems to have been already known, or worked its way eastward from the Mediterranean civilization, perhaps at the time of the visit of the forces of Alexander. The unit fraction is in evidence, as it was in Egypt and Babylon two thousand years earlier. The mensuration of the circle is also a feature of the S'ulvasūtras. The most interesting suggestion made by Mr. Kaye in this connection relates to a circle of diameter d and area a^2, namely, that the relation

$$d = a + \tfrac{1}{3}(a\sqrt{2} - a),$$

which is given in the editions of Āpastamba and Baudhāyana, led to the relation

$$a = d\left(1 - \frac{1}{8} + \frac{1}{8.29} - \frac{1}{8.29.6} + \frac{1}{8.29.6.8}\right)$$

through the substitution for $\sqrt{2}$ of

$$1 + \frac{1}{3} + \frac{1}{3.4} - \frac{1}{3.4.34},$$

which value is given earlier in the S'ulvasūtras. Mr. Kaye asserts, however, that this substitution was beyond the powers of the Hindu mathematicians of that period, and it is a fact that we have no other evidence of any ability to make such a substitution.

As far as our present knowledge goes, there is a gap between the S'ulvasūtra mathematics and the first distinct treatises on the subject, such as the Sūrya Siddhānta, the anonymous astronomical classic of about A.D. 400. This work was included in the great collection made by Varāha Mihira in the sixth century, and the evidence seems to show that, by this time, more or less of Greek mathematics was known in India. Ptolemy's influence seems to be evident in the table of chords given by Varāha Mihira, but the earliest known use of the sine occurs in the Hindu works of this period.

Mr. Kaye summarizes the work of Āryabhaṭa in a satisfactory manner, making no mention of the younger mathematician of the same name to whom he devoted some attention a few years ago. Indeed, his statement that "the Indian works record distinct advances on what is left of the Greek analysis" is perhaps the most outspoken statement in favor of the Hindu algebraists to be found in any of his writings.

Noteworthy among the special topics studied by Mr. Kaye are the Hindu methods of solving the equation $Du^2 + 1 = t^2$, beginning with Brahmagupta in the seventh century, together with a conspectus of the indeterminate problems dealt with in India. The problems of the rational right triangle and the value of π, attractive ones to the Hindu writers from Brahmagupta on, are also studied by Mr. Kaye and two helpful synopses are given. A brief study of the connection between Chinese and Hindu mathematics is also given, and the proof which is adduced seems to be valid that Mahavir, in the ninth century, was acquainted with certain Chinese works. This acquaintance appears, for example, in the treatment of the area of a segment of a circle and in two or three applied problems. It is doubtful, however, if this relationship and others like it are sufficient ground for the sweeping assertions contained in the following statements:

> That the most important parts of the works of the Indian mathematicians from Aryabhaṭa to Bhāskara are essentially based upon western knowledge is now established. A somewhat intimate connection between early Chinese and Indian mathematics is also established. That the Arabic development of mathematics was practically independent of Indian influence is also proved.

It would be safer to say that the solution of the problem of the relationship between the scholarship of the East and that of the West has hardly yet been begun.

Two helpful features of the work are the large number of extracts from the original treatises, and a fair bibliography. Mention should also be made of two interesting photographic reproductions, one of two pages of Srīdhara's *Trisátikā* and the other of three pages of the Bakhshālī manuscript. There is also a helpful index to the work.

The book, small though it is, should be on the shelves of all who are interested in Oriental mathematics. It is to be hoped that Mr. Kaye will some time prepare a more exhaustive work upon the subject.

DAVID EUGENE SMITH

Assaying in Theory and Practise. By E. A. WRAIGHT, of Royal School of Mines, London. Longmans, Green and Co. Pp. 316. 86 figures in text. $3.00.

The text of the book is divided into four parts. *First:* Numerical Data, Laboratory Plans, Lists of Apparatus, Minerals and Their Characteristics. *Second* Part: Dry Assaying; contains chapters on tests for recognition of various metals, sampling, general assay problems and methods of assay for tin, gold, silver, lead, mercury, fuels and refractory materials. *Third* Part: Wet methods for iron, copper, zinc, aluminum, lead, bismuth, tin, tungsten, arsenic, antimony, manganese, chromium, sulphur, vanadium, cobalt, nickel, uranium and molybdenum. *Fourth* Part: Control tests for cyaniding solutions and cyaniding methods.

It is rather doubtful whether any one, who was not fairly well grounded in chemistry and chemical manipulation, could make much progress in assaying by the use of the book alone. The methods given leave much to the mind of the reader. In the tests for recognition, a wet and a dry test are given for each element. No mention is made of the influence of other elements which may hide the test entirely. In the description of grinding no mention of the mechanical grinders is made. The iron mortar and the backing board are recommended, notwithstanding the fact that some form of mechanical grinder is found in almost every assay laboratory.

Gas furnaces and oil furnaces are also omitted from the description. These furnaces may not be in common use in England, but they are found everywhere in this country.

The reviewer does not agree with some of the methods recommended, but that is perhaps only a difference of opinion.

But one form of calorimeter is described, but the principles of calorimetry are well described.

The book furnishes much in a suggestive way and may be taken as a good outline for a course in assaying, but the course would have to be supervised by a competent instructor.

OWEN L. SHINN