outlines are too hard and the colors not quite true; there is too much of the mannerism of the artist. The colored plates in Professor Thomson's book also seem to me criticizable; they look a little out of focus, as it were—much as things look to the present writer when he has mislaid his glasses.

On the chance that some of our active workers in genetics have not recently read their "Selborne," it may be worth while to quote the following pertinent information: "One thing is very remarkable as to the sheep: from the westward till you get to the river Adur all the flocks have horns, and smooth white faces, and white legs; and a hornless sheep is rarely to be seen: but as soon as you pass that river eastward, and mount Beeding-hill, all the flocks at once become hornless, or, as they call them, poll-sheep; and have moreover black faces with a white tuft of wool on their foreheads, and speckled and spotted legs: so that you would think that the flocks of Laban were pasturing on one side of the stream, and the variegated breed of his son-in-law Jacob were cantoned along on the other. And this diversity holds good respectively on each side from the valley of Bramber and Beeding to the eastward, and westward all the whole length of the downs. If you talk with the shepherds on this subject, they tell you that the case has been so from time immemorial, and smile at your simplicity if you ask them whether the situation of these two different breeds might not be reversed. However, an intelligent friend of mine near Chichester is determined to try the experiment; and has this autumn [1773], at the hazard of being laughed at, introduced a parcel of black-faced hornless rams among his horned western ewes. The black-faced poll-sheep have the shortest legs and the finest wool."

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THE HINDU-ARABIC NUMERALS

IN a recent number of SCIENCE[1] I ventured to assert the correctness of the statement that our present decimal place system with the zero is of Hindu origin. The veteran historian of mathematics, Moritz Cantor, makes substantially the same assertion in the latest edition (1907) of the first volume of his "Vorlesungen über Geschichte der Mathematik," p. 608. He says, referring to the use of words with place value.[2]

> This kind of conscious juggling with the notions of positional arithmetic together with the zero, is most easily explained in the home of these notions, which (home) for us is India and this we may affirm even if there is question of a second home. We mean if both notions were born in Babylon, of which there is great probability, and were carried over into India in a very undeveloped state.

We may add that neither Cantor nor any other has yet presented any historical evidence that these ideas were carried over to India from Babylon. Eneström, the editor of the *Bibliotheca Mathematica,* a journal devoted to the history of mathematics, has recently[3] supported the view that the Babylonian arithmetic is not of the same nature as our system. The Babylonians did not use the zero, so far as we know, with the same notion of place value for purposes of computation as in the Hindu system. The Babylonian multiplication tables published by Hilprecht which include tables of 1,800 times various numbers are an evidence of this fact. In a fully developed sexagesimal (60) system this table would be replaced by the table of thirty times the corresponding numbers, since 1,800 equals 30 times the unit of higher order, 60. Furthermore, the Babylonian system was not adapted for computation because of the mixture of decimal and sexagesimal systems and further because of the large base, 60.

Recently another early document referring to the Hindu numerals has been published. This document is of prime importance because, being written in 662 A.D., it antedates by more than two centuries the earliest known appearance in the ninth century of the numerals in Europe. The probability is, too, that the

[1] January 5, 1912.

[2] See Smith-Karpinski, "The Hindu-Arabic Numerals," p. 39, for an explanation of this system.

[3] *Bibliotheca Mathematica,* Vol. XI. (3), 1911, p. 331.

numerals were fully developed in India not much more than two centuries before this time. We are thus brought very close to the time of the origin of the powerful symbols which we use for computation. Further, the passage is of interest because it explicitly mentions the Babylonian contributions to astronomy and we must conclude that if the writer at that early date had known of any connection between the Babylonian number system and the Hindu he would have mentioned it. The passage in question is presented by M. F. Nau in some notes on Syrian astronomy.[4] M. Nau quotes from the writings of one Severus Sebokt, bishop of the monastery at Quennesra, on the Euphrates, near Diarbekr. This Sebokt was famous in a literary way and made his monastery a center of Greek learning. He himself was originally from Nisibin towards India, and it is not beyond the bounds of probability that there he came into contact with the learning of the Hindus.

Sebokt claimed for the Syrians the invention of astronomy. He stated that the Greeks went to school to the Chaldeans of Babylonia and these, he adds, are Syrians. This statement of Sebokt's is supported by the most recent investigations in the history of the development of science. An interesting article on this subject was published by F. Cumont, entitled "Babylon und die griechische Astronomie."[5] Sebokt concludes that science is not the peculiar property of the Greeks, but rather open to all men.

The subsequent passage contains the reference to the numerals and I translate from the French translation given by M. Nau:

I omit now to speak of the science of the Hindus, who are not Syrians, of their subtle discoveries in this science of astronomy—(discoveries) which are more ingenious than those of the Greeks and even of the Babylonians—and of the easy method of their calculations and of their computation which surpasses words. I mean that made with nine symbols. If those who believe that they have arrived at the limits of science because they speak Greek had known these things, they might perhaps have been persuaded, even though a little late, that there are others who know something, not only the Greeks, but even people of a different language.

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[4] *Journal asiatique*, Vol. 16 (10th series), 1910, pp. 225–227.

[5] *Neue Jahrbücher f. das klass. Altertum, Gesch. und deutsche Literatur und f. Pädagogik*, 1911, Vol. 27–28, pp. 1–10.

SPECIAL ARTICLES

THE SOURCE OF THE CURRENT OF INJURY

When we connect calomel electrodes filled with KCl solutions of the same concentration with the uninjured skin and an injured spot of an apple, respectively, we notice a potential difference from between 40 to 100 millivolts, the injured spot of the apple being negative to the uninjured spot. We have made experiments which indicate that the so-called current of injury is due to a difference of potential which exists on the inside of the skin of the apple probably at the limit between the skin and an adjacent layer of cells, the latter being negative to the former. The proof for this statement is found in the following facts.

1. When we form a cell of the type

$n/10$ KCl uninjured side | Apple | $n/10$ KCl injured side

the E.M.F. remains the same no matter how deep a hole we make into the apple. As soon, however, as the $n/10$ KCl approaches the inner surface of the apple the E.M.F. suddenly becomes smaller and finally disappears.

This is not due to an injury of the skin itself, since a change in the concentration on the outer surface of the skin still gives the same change in E.M.F. as in an intact apple. The disappearance of the "current of injury" when the salt solution reaches the inner surface of the membrane of the apple is therefore due to the disarrangement or destruction of a specific layer on the inside of the surface film of the apple.

2. By pressing the surface of an apple with a finger we can destroy the adjacent layer on the inside of the skin without injuring the