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 computa-

[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.

tion 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.

Louis C. Karpinski

University of Michigan

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

$$n/10 \text{ KCl} \quad | \quad \text{Apple} \quad | \quad n/10 \text{ KCl}$$
$$\text{uninjured} \qquad\qquad\qquad \text{injured}$$
$$\text{side} \qquad\qquad\qquad\qquad \text{side}$$

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

latter. This can again be proved by measuring the influence of the change of concentration of a salt solution on that outer surface, which is exactly the same as it was before the pressure was applied. If, however, we connect this part of the skin and an intact part of the skin with a pair of calomel electrodes filled with a KCl solution of the same concentration, we get an E.M.F. of the same order of magnitude and the same sign, as if the skin at the pressed spot had been removed. This experiment, which is very striking, indicates also that the current of injury is due to the existence of a potential difference at the inner surface of the skin of the apple which depends upon the integrity of a definite structure.

3. An attempt to account for the nature of this E.M.F. led to the discovery that salts and acid, if applied in the same concentration to the outside surface of an apple, give rise to differences of potential of the same order of magnitude as found in the current of injury. The E.M.F. of the cell

$n/10$ NaCl | uninjured apple | $n/1,000$ NaCl | $n/10$ NaCl   (I.)

is greater than that of the following cell

$n/10$ NaCl | uninjured apple | $n/1,000$ HCl | $n/10$ NaCl   (II.)

In (I.) the E.M.F. was .088 volt, in (II.) .038 volt.

4. Since this difference is of the order of magnitude of that found in the current of injury, it was natural to test the action of the juice pressed out of the apple. Its conductivity was found to be $K_{18}o = .00226$. This would correspond to a concentration of $n/58$ if the electrolyte contained in the sap were KCl, or $n/170$ if it were HCl. The apple juice contains a considerable amount of malic acid. Nevertheless it does not have the negative effect characteristic of the acid. If the negative potential on the inside of the skin is due to a layer of acid it must differ in its action from the sap pressed out from the apple.

These experiments indicate that the current of injury of the apple is due to a potential difference at the inner limit of the skin or membrane; and that this potential difference depends upon the integrity of a preformed structure. This structure may give rise to the formation of a film of an acid but this is hypothetical.

Our observations prove that Hermann's alteration theory of the current of injury can not be correct. This theory assumes that the difference of potential exists at the injured surface, while the experiments mentioned here show that the seat of the potential difference is, at least for the apple, not at the seat of the lesion, but at the inner limit of the intact skin or membrane and its intact adjacent layer. DuBois's preformation theory is confirmed, although in a different form from that which this author suggested.

JACQUES LOEB,
REINHARD BEUTNER
DEPARTMENT OF EXPERIMENTAL BIOLOGY,
ROCKEFELLER INSTITUTE

SOCIETIES AND ACADEMIES

THE BIOLOGICAL SOCIETY OF WASHINGTON

THE 498th regular meeting of the society was held in the assembly hall of the Cosmos Club on April 13, 1912, with President Nelson in the chair.

Under the head of General Notes, Dr. B. W. Evermann exhibited dyed and undyed skins of fur seals from the Pribilof Islands, and made remarks on the commercial classification of skins and on the aims of the Bureau of Fisheries regarding the fur-seal industry.

The paper of the evening was by Mr. Chas. Sheldon on "Winter Animal Life about the Base of Mt. McKinley." Mr. Sheldon gave an interesting account of his experiences with the birds and mammals of the Mt. McKinley region during the winter of 1907–08, describing in detail the food and habits of the Alaska jays, the mallard ducks, which were found wintering where local conditions favored open water and sufficient food, the lynx, conies, foxes, caribou, moose and sheep. Mr. Sheldon's lecture was admirably illustrated with numerous lantern slides, showing his cabin, general and detailed views of the country and long- and short-range snap shots of all the larger animals of the region.

THE 499th regular meeting of the society was held in the assembly hall of the Cosmos Club on