was named after his wife. There were two other boats, the *Nellie Powell,* named after Mrs. Thompson, and the *Cañonita.*

THE Bureau of Ethnology has received the first report of the field activities of the party undertaking archeological reconnaissance in the eastern section of Honduras, made up of Dr. W. D. Strong, of the bureau staff, Alan W. Payne, and Norman Haskell. The report states that on February 10 the party left Puerto Castilla, proceeded to the mouth of the Patuca River, and went upstream. Studies were undertaken on the Guampu and Cuyamel Rivers, tributary to the Patuca. Two archeological sites marked by the presence of earth mounds were studied and excavated. The few remaining Sumu Indians were encountered, and a brief study was made of them. The conclusion was reached that the Maya culture did not extend that far to the eastward, as nothing indicative of this culture was found. The party learned that several hundred Sumus had been living on the river until four years ago, when an epidemic of smallpox swept them away. The next trip to be made will be from the westward of the Patuca Valley overland *via* muleback into the mountain region.

DISCUSSION

A CIVILIZATION WITHOUT NATIVE MATHEMATICS

IN a recent number of the historical periodical entitled "Quellen und Studien zur Geschichte der Mathematik, Astronomie und Physik," volume 2 (1932), page 255, there appears an article by P. L. van Hee, in which it is stated that if the Chinese mathematical books of every epoch would disappear science would suffer no loss as regards mathematics. It is claimed here that China has contributed nothing towards raising the edifice of modern mathematics, but that the mathematics which appears now in the Chinese literature is due to other nations and was often credited by Chinese writers to natives of their own country. Among the recent writers who are said to have been misled by these false claims is Y. Mikami, whose work entitled "The Development of Mathematics in China and Japan," 1913, is widely known and has been frequently referred to as an authority.

There is a remarkable contrast between the recent historical developments relating to China and those relating to Egypt and Babylonia. In the former case these developments seem to tend to show that their early mathematical attainments were overestimated, while in the latter they were underestimated, especially as regards Babylonia. In particular, the issue of the periodical noted above contains also the remarkable announcement that the ancient Babylonians had a rule equivalent to a general formula for the sum of the squares of the first n natural numbers. It was formerly supposed that the first discovery of such a rule was due to the ancient Greek mathematicians. A few years ago it was announced that the ancient Egyptians had a rule which is equivalent to our modern formula for the area of a sphere, but this seems now to be incorrect, having been due to a mistranslation.

The chief interest in the article to which we referred at the beginning of this note is due to the fact that it exhibits a lack of mathematical initiative on the part of the Chinese extending over a long period of time. When mathematics was introduced from other countries it received considerable attention and some of it was permanently retained, but no definite evidences of native advances seem as yet to have been established. The exaggerated claims made by some of the Chinese writers have really been harmful to the reputation of their country and they have made it difficult to form a correct judgment as regards their possible contributions It seems clear, however, that from the standpoint of mathematics ancient China was far behind ancient Egypt and ancient Babylonia. Their ancient as well as their modern civilization exhibits unusual mathematical weakness and many of the references to their achievements along this line are untrustworthy according to some of the most recent investigations.

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THEORIES OF CORTICO-ADRENAL FUNCTION

WITHIN the past year three theories of cortico-adrenal function have been advanced. They postulate that the adrenal cortex (1) prepotently regulates carbohydrate metabolism,[1] (2) produces a general tissue hormone,[2] (3) controls the circulating blood volume.[3] The first appeared about a year ago, the second shortly after, and the third in January of this year.

In presenting their theory of blood-volume regulation and the relation of the adrenals to shock, Swingle and his associates ride rough-shod over other hypotheses. "None," they state, "have materially advanced (*sic*) the problem of cortical function." Not even a foot-line was given to bibliographic mention of the earlier theories mentioned above.

It is not *in justitia scientiae* merely that mention should be made of the praiseworthy contributions of

[1] S. W. Britton and H. Silvette, *Amer. Jour. Physiol.,* 100: 701, 1932.

[2] F. A. Hartman, K. A. Brownell and J. E. Lockwood, *Endocrinology,* 16: 521, 1932; *Amer. Jour. Physiol.,* 101: 50, 1932.

[3] W. W. Swingle, *et al.,* SCIENCE, 77: 58, 1933.

Hartman and his colleagues toward the elucidation of cortico-adrenal problems. Contemporaneously with, if not prior to Swingle and Pfiffner, the Buffalo investigators produced a potent extract of the adrenal cortex, and they have published extensively on its effects. Furthermore, they have formulated a theory of cortico-adrenal function as noted above, and supported it with considerable experimental evidence.

That the adrenals are of importance in maintaining a normal circulation has been known for many decades, and the ideas of Swingle and his associates are not at all novel. In a small section of a review a few years ago, one of us (Britton)[4] drew attention to more than a score of observations on the subject. Antedating by two years the recent report of Swingle *et al.*, there appeared a comprehensive experimental study by Wyman and Suden on "The blood volume in suprarenal insufficiency, anaphylactic shock and histamine shock."[5]

Our own observations lead us to conclude that changes in blood pressure and in the amount of circulating blood are indirect and illustrative only of the general effects of adrenalectomy throughout the body. We have sought an understanding of the *underlying* chemical changes and conditions in adrenal insufficiency which are antecedent to, or take precedence over, because of their critical nature, the altered permeability relationships in the body.

Breakdown to the point of utter collapse of the normal carbo-metabolic processes appears to us still to constitute the primary critical contingency in adrenal insufficiency. The adrenalectomized animal suffers from glucose and glycogen lack, which becomes progressively more severe after the operation, and parallels the development of symptoms. All the symptoms, too, are compellingly suggestive of severe hypoglycemia. We have never observed such profoundly critical glucose and glycogen disturbances in any other cachexic status which involves carbohydrate metabolism—*e.g.*, the cachexia following hepatectomy or pancreatectomy or heavy insulin dosage. Cortico-adrenal extract appears to have a primary effect, moreover, in restoring promptly the normal carbohydrate levels.

Animals dying of adrenal insufficiency show convulsive seizures some hours before death which are identical in type with those observed in insulin hypoglycemia. By contrast we have never observed such convulsions in animals in which the circulating blood volume has been markedly reduced by hemorrhage and other operative procedures.

It may be that carbohydrate deficiencies do not explain the whole problem of adrenal insufficiency. Glucose does not prolong the lives of adrenalectomized animals many days. Similarly, carbohydrate injections only slightly extend the survival of hepatectomized animals. In a number of cases we have observed, too, that glucose does not restore severely insulinized animals. Many substances are furthermore known to reduce the blood sugar in diabetes, but that without remedy. It is to be emphasized in this connection that we have been concerned for the present simply with *the first crucial signs of failure* in the adrenalectomized animal. That there occurs primarily and fundamentally a failure in glycotaxis in the body appears as best fitting the mass of evidence at hand.

Swingle and his colleagues state that in cases of adrenal insufficiency blood dilution "never occurs . . . unless the hormone is injected." In our experiments we have observed that restoration of the normal blood volume of adrenalectomized animals may readily be brought about by saline injections. The symptoms of insufficiency are not at all ameliorated by such restoration, however, nor is life even slightly prolonged. In contrast, augmentation of the blood sugar by glucose injections alleviates the symptoms very rapidly, and lengthens significantly the survival period.

We have observed that the adrenalectomized animal is somewhat hydrated, rather than dehydrated.[6] Increased amounts of water are held in the hepatic and muscular tissues. The blood plasma and total blood volume are in contrast reduced, but not until symptoms are developed are these reductions noteworthy. Fluid accumulations in the liver and muscle in adrenal insufficiency more than balance the loss of fluid by the blood.

We gain the impression from our data that water is more necessary for the maintenance of normality conditions in the liver and muscle than for any of the demands of the circulation, important though the latter may be. Furthermore, one of the earliest and most striking effects of cortico-adrenal extract which we have observed is the *elimination* of fluid by the production of a striking diuresis. Space limits can not be imposed on for further considerations here.

The most critical emergency in the career of the adrenalectomized animal results from virtually complete disappearance of liver glycogen, and concomitantly profound reduction of blood sugar, as well as muscle glycogen. Thus, severe hypoglycemic convulsions supervene, and death results during the convulsive seizures. Our data compel adherence to our first-proposed theory of the prepotent function of the adrenal cortex—that of the regulation, in cooperation

[4] S. W. Britton, *Physiol. Rev.*, 10: 617, 1930.

[5] L. C. Wyman and C. tum Suden, *Amer. Jour. Physiol.*, 94: 579, 1930.

[6] H. Silvette and S. W. Britton, *Amer. Jour. Physiol.*, (in press), 1933.

with other tissues or secretions, of carbohydrate metabolism in the organism.

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THE "SPREAD" OR "SCATTER" OF THE INFLUENCE FROM A REWARD, IN RELATION TO GESTALT DOCTRINES

IN SCIENCE of February 10, I reported the discovery of the "spread" or "scatter" of the influence of a reward, and especially the significance of the phenomenon as an independent proof of the so-called law of effect. Circumstances prevented a prompt reply to Ogden's criticisms (SCIENCE, March 3) and the need has perhaps vanished as a result of Boring's ingenious *modus vivendi* for Gestaltists and connectionists (SCIENCE, March 24). But I venture to note the following:

The "whole process" in my experiments consists of 40 words chosen at random said by the experimenter, to each of which the subject responds by a number from 1 to 10, or of equally arbitrary multiple choices. An announcement of "Right" after one of the 40 word-number units in the experiments certainly does not strengthen or confirm the whole process equally. An announcement of "Wrong" seems to the observers to be as "final" or as "consummatory" of, the connection it follows as an announcement of "Right." Certainly any difference in this respect is very small, but the difference in strengthening of the connection is enormous. And this enormous difference uniformly goes with the satisfyingness of the after-effect.

My note in SCIENCE presented evidence for these conclusions: (1) The strengthening of the connection which the reward immediately follows and to which it belongs does not occur indirectly by reason of repetitions or rehearsals of the connection or by way of memories that such and such a number was right, or successful, or rewarded for such and such a word, because the announcements of "Wrong" have no negative influence comparable to the positive influence of the announcement of "Right."

(2) The reward does not have to search out the "right" or "successful" act by any mysterious power and attach itself to it, as Peterson has objected. It strengthens whatever its physiological equivalent influences in the neurones.

(3) The reward strengthens chiefly the connection which immediately precedes it and of which it is (by sophisticated humans) felt to be the after-effect. But it also strengthens the connections one and two steps further back or forward, though these were definitely punished and most emphatically did *not* belong to the reward in the Gestalt's meaning of "belong" if I understand them. Each belongs to its punishment. Nothing happening to the subject equally near the time of the reward could belong to it much less in the sense of forming with it a "perfectly integrated unit."

In the very different sense in which I use the word, the reward may belong to these preceding and succeeding connections, though rather tenuously and indirectly, as neighboring tasks related only by the conditions of the experiment.

I can guarantee this. Let any Gestaltist choose a hundred multiple-choice tasks as "discrete and independent" one from another as he can find or make, each composed of a situation and n responses from which choice is to be made such that the situation and the responses are as "discrete and independent" from each other as he can find or make, and let him choose rewards and punishments as "discrete and independent" from anything in the tasks as he can find and make. Then the situation-response connection which has a reward attached to it utterly arbitrarily by the experimenter will be strengthened thereby, so long as it is a satisfying after-effect of that connection to the learner. And the influence of the reward may, and often will, spread or scatter so as to strengthen other connections in the physiological neighborhood.

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STRATIGRAPHIC NOMENCLATURE

IN SCIENCE (Vol. 76, p. 489) Professor G. D. Harris, of the Paleontological Laboratory, Cornell University, writes: "Perhaps others as well as the writer have often been at a loss for a concise, logical and self-explanatory term for indicating all that portion of the geologic sequence (or geologic time) below or antedating the Cambrian system (or time). Strangely enough, the embarrassment becomes more acute if one searches for a term to include the Paleozoic, Mesozoic and Cenozoic."

I want to make the statement, that in my "Textbook of Geology" (*Lehrbuch der Geologie,* Wien, 1924) I introduced the term "Euzoische Schichtfolge" (Euzoic sequence), which includes the Paleozoic, Mesozoic and Cenozoic.

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FREQUENCY OF VERTEBRATE FOSSILS IN RIVER DEPOSITS

THE following observation, dated "Monday 17, 1805," taken from "History of the Expedition of Captains Lewis and Clark,"[1] is of more than usual interest

[1] Vol. I, p. 352, New Amsterdam Book Company, New York.