Society, which administers the Aquarium at the Battery and the Bronx Zoological Park, is making a survey to determine the best site for a new aquarium.

THE third summer conference of the New England Association of Chemistry Teachers will be held at the University of Connecticut, Storrs, from August 12 to 15. A symposium is planned on the afternoon of each day on modern concepts of electrolytes. George B. Savage, Loomis School, Windsor, Conn., is chairman of the conference committee.

THE eleventh annual meeting of the American Malacological Union will be held at Thomaston and Rockland, Maine, from August 26 to 29.

THE second American Congress on General Semantics will be held on August 1 and 2 at the University of Denver.

THE summer meeting of the Pennsylvania Academy of Science will be held in Bedford, Pa., over the week-end of August 8–9. Field trips to study the local natural history will be taken. For further information write to Dr. V. Earl Light, Lebanon Valley College, Annville, Pa.

THE Society of American Bacteriologists, the American Association of Immunologists and the American Society for Experimental Pathology would like to receive nominations for the Eli Lilly and Company Research Award in Bacteriology and Immunology. This award is to be made to the young man or woman working in a college or university, who in the opinion of the Award Committee, has done "the most outstanding work in the field of bacteriology or immunology." To be eligible for the award, the individual must not have passed his or her thirty-fifth birthday on April 30, 1941. Information concerning the award may be secured from I. L. Baldwin, University of Wisconsin, Madison. Nominations must be in his hands before September 15.

DISCUSSION

INDUCED BIOTIN DEFICIENCY AS A POSSIBLE EXPLANATION OF OBSERVED SPONTANEOUS RECESSIONS IN MALIGNANCY

MORE than 300 authenticated cases of spontaneous recession of malignant tumors in man have been reported in the literature by a number of authorities between 1890 and 1917. Rohdenburg, who compiled a comprehensive summary of these cases,[1] records that about a hundred of these recessions have been observed to take place "subsequent to, or during, an acute infection." Recessions had been observed to occur after smallpox, pneumonia, malaria and acute tuberculosis. However, "the greater number of cases in this group," Rohdenburg found, "have occurred after an attack of erysipelas, an observation which led to the use of toxins of the causative organisms as a therapeutic measure" (Coley's Fluid).

Recently, West and Woglom, in studies on the biotin content of tumors and other tissues,[2] found it "significant that in every case studied the biotin level of the tumor deviated sharply from the normal adult values in the same direction as that of the corresponding embryo tissues." For example, they found a fourfold increase in the biotin content of the embryo lung as compared with the normal adult lung of the rat, while the biotin content of cancerous tissues from the human lung was found to be about three times the biotin content of the normal tissues of the human adult lung. "Other tumors of epithelial origin, obtained from human sources," they reported, "have also been found directly richer in the growth substance (*i.e.,* biotin) than adjacent normal tissues."

It is by now well established that biotin, found last year to be identical with coenzyme R and vitamin H, the anti-egg-white-injury factor,[3] is essential for the vital functions of many organisms[4, 5, 6, 7, 8] and higher animals.[9, 10] No form of bacteria has so far been found that does not require it, though some have been found to possess the ability to synthesize it from available materials. Eakin, McKinley and Williams have shown that the tissues of chicks on a diet causing egg-white injury were deficient in biotin despite the abundance of this vitamin in the diet.[11] Later, Eakin, Snell and Williams[12] presented experimental evidence to show that commercial or fresh egg white is capable of inactivating biotin *in vitro,* "owing probably to the

[1] G. L. Rohdenburg, *Jour. Cancer Research,* 3: 193, 1918.

[2] P. M. West and W. H. Woglom, SCIENCE, 93: 525, 1941.

[3] P. György, D. B. Melville, D. Burk and V. du Vigneaud, SCIENCE, 91: 243, 1940; V. du Vigneaud *et al.,* SCIENCE, 92: 62, 1940; P. György *et al.,* SCIENCE, 92: 609, 1940.

[4] F. Kögl and B. Tönnis, *Zs. phys. Chem.,* 242: 43, 1936.

[5] P. M. West and P. W. Wilson, *Enzymologia,* 8: 152, 1940.

[6] R. Nilsson *et al., Ann. Landw. Hochschule Schwedens,* 7: 301, 1939.

[7] E. E. Snell and R. J. Williams, *Jour. Am. Chem. Soc.,* 61: 3594, 1939.

[8] J. R. Porter and M. J. Pelczar, *Jour. Bact.,* 41: 173, 1941.

[9] P. György, *Jour. Biol. Chem.,* 131: 733, 1939.

[10] P. György *et al.,* SCIENCE, 91: 243, 1940.

[11] R. E. Eakin, W. A. McKinley and R. J. Williams, SCIENCE, 92: 224, 1940.

[12] R. E. Eakin, E. E. Snell and R. J. Williams, *Jour. Biol. Chem.,* 136: 801, 1940

formation of a fairly stable compound of biotin with a special constituent of egg white." György *et al.*[13] later reported the isolation of a special constituent from raw egg white, called by them "avidalbumin" (recently changed to "avidin"), which showed itself more potent than egg white in producing egg-white injury, and also in biotin-binding capacity *in vitro*, thus establishing avidin as the special egg-white-injury constituent in raw egg white. This led them to assume that egg-white injury is a biotin-deficiency, brought about by "the unavailability of biotin because of its fixation to the avidalbumin" (avidin).

These developments, taken as a whole, lead to certain logical assumptions which, if proved to be correct in future experimental and clinical tests, would provide at least one explanation for the hitherto unexplained phenomenon of the spontaneous recessions in malignancy. For this reason the writer feels justified in offering the following as working hypotheses:

(1) Both the malignant cells and the micro-organisms associated with the observed cases of spontaneous recession require excess biotin for their metabolic activities. Two lines of evidence mentioned earlier would seem to support this hypothesis.

(2) If this hypothesis is proved correct, and it should not be too difficult to check, then the spontaneous recessions could be explained as the direct result of biotin-deficiency brought about by the avidin-like action of the micro-organisms, and particularly the streptococcus erysipelatos, depriving the malignant cells of a factor vital for their continued existence.

(3) The dermatitis in erysipelas may in itself be a human form of egg-white injury, *i.e.*, unavailability of biotin brought about by the avidin-like action of the erysipelococcus.

(4) Raw egg white, or avidin, because of their ability to deprive pathogenic bacteria and malignant cells of a life-essential factor, suggest themselves as new therapeutic agents in conditions due to the presence of these entities. The resultant biotin deficiency could be controlled at any desired stage by the administration of definite amounts of biotin.

Butter-yellow rat liver tumors are relatively low in biotin[2] but this fits well into the general picture, as West and Woglom found the biotin content of the heart, liver and kidney of embryos to be appreciably lower than that of the normal adult heart, liver and kidney. Since the liver is known to act as the storage depot for vitamins of the B complex, the low biotin content of the butter-yellow rat liver tumors may be taken as an indication that tumor tissues of the liver do not possess the function of storage. If that is so, and this assumption seems logical in the absence of any evidence to the contrary, then the relatively low biotin content of the butter-yellow liver tumors, not necessarily low in absolute values, may be explained on the grounds that the tumors have used up the stored biotin, thus giving added support to hypothesis I.

While it is probable that some, if not most, of these suggestions are now under consideration, or are being tested, by others, they are hereby presented in the hope that they may prove useful in crystallizing an idea.

WILLIAM L. LAURENCE

[13] P. György *et al.*, SCIENCE, 93: 477, 1941.

PRE-EUCLIDEAN GREEK MATHEMATICS

IN a recent number of the well-known German periodical entitled *Mathematische Annalen,* dated January 14, 1941, it is announced that the "Jablonowskischen Gesellschaft der Wissenschaften" is offering a prize of R. M. 500 for an investigation which will increase our knowledge of the older Greek arithmetic and algebra, especially of the arithmetic of the Pythagoreans, of which it is stated here very little has been transmitted to us. The hope is expressed in this announcement that the recent discoveries with respect to the mathematics of the ancient Babylonians and the writings of the ancient Greeks relating to music may unitedly be able to throw new light on Greek arithmetic. Competing mss. for this prize are to be written either in German or in Latin and will be received by the said association up to the end of the year 1942.

A significant feature of this announcement is that it emphasizes the wide-spread and growing recognition of the fact that our present knowledge of the ancient Greek mathematics is still very imperfect, notwithstanding the enormous extent of the writings on this subject in recent years. Some years ago it was commonly regarded as sufficient to collect and quote Greek authorities, but in view of the fact that many of these are contradictory and were written long after the supposed discoveries to which they relate were made much less credence is now commonly given to these quotations than formerly. At least they are no longer regarded as final. The much more difficult method of examining critically the authenticity of various statements has been widely adopted, and this has naturally greatly increased the labors of the mathematical historians. This has been true, in particular, as regards many of the discoveries which have been commonly credited to Pythagoras, including the famous theorem known by his name but which was used by the Babylonians many centuries before Pythagoras was born.

The fact that the competing mss. for this prize are to be written either in German or in Latin is somewhat striking, but it can readily be understood when it is