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.

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[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

remembered that in 1936 a mathematical periodical was started in Germany under the title *Deutsche Mathematik,* which has since then been widely supported by German mathematical writers even if the contents exhibit the fact that mathematics is an international subject which contains many evidences of the cooperation of writers of many lands. In recent years the German contributions have been extensive, but they were largely based on the earlier contributions of writers in other lands including the Greeks whose achievements the noted prize may help to clarify and to whom the entire mathematical world has often acknowledged itself indebted notwithstanding the growing credit to earlier civilizations.

This prize and the recently reported appointment of a professor of the history of mathematics in the University of Berlin seem to imply that this history is now receiving relatively much attention in Germany, notwithstanding the fact that the present disrupted condition in scientific work makes the unbiased study of this subject very difficult. The articles in the periodical noted in the preceding paragraph also indicate an emphasis on the history in recent German mathematical writings. In so far as these efforts are directed towards learning the actual situations they naturally receive the approval of all and should be especially appreciated in America in view of the relatively small amount of such work in our rapidly expanding mathematical activities of recent years. According to Felix Klein the thinking through of old problems by new methods is the source of pure mathematics.

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CROSS-FERTILIZATION OF ECHINODERMS

IT has long been known that the sea urchins *Strongylocentrotus purpuratus* and *S. franciscanus,* will cross-fertilize, reciprocally, but every investigator has noted that the percentage of cross-fertilizations is extremely variable. During a recent stay at the Hopkins Marine Station at Pacific Grove, Calif., it was found that the variability was largely due to the method of preparing the eggs for experimental use. The usual procedure of preparing sea urchin eggs is as follows:

The ovaries are removed from the cut animal and placed in a fairly large quantity of sea water; this is filtered through cheese-cloth to remove the débris from the exuded eggs; some investigators advocate several washings of the eggs with fresh sea-water; then a small quantity of the eggs are pipetted off into a Syracuse watch glass containing fresh sea water, and the sperm added. Using eggs prepared in this manner, it was found that when crossed with the sperm of the other species, very few eggs were fertilized, though 100 per cent. fertilizations occurred with the sperm of its own species. If, however, the eggs were taken directly from the ovary of the cut animal and left crowded together in sea water in a Syracuse watch glass and immediately fertilized with the sperm of the other species, quantities of the eggs were fertilized. In the cross, *Strongylocentrotus purpuratus* ♀ × *S. franciscanus* ♂, the percentage, in one experiment, was 1 per cent. fertilizations with eggs prepared in the usual way (well washed and separated), and 80 per cent. with eggs direct from the ovary and crowded. The same batch of eggs, and sperm from the same male, were used in the experiment, and the counts were made of the blastulae just before swimming. The experiment was repeated with many different batches of eggs with the same general result; the reciprocal cross gave similar results, but the difference was not so great. In all cases, a large quantity of sperm was used, as it has long been known that over-insemination increases cross-fertilizations.

When the eggs of the sea urchin, *Strongylocentrotus purpuratus,* were crossed with the sperm of an entirely different genus, *Dendraster excentricus,* a sand-dollar, not a single fertilization was observed when the eggs were prepared in the usual way. But when the eggs from the same female were taken directly from the ovary and left crowded together and crossed with the sperm from the same *Dendraster* male, 10 per cent. of the eggs were fertilized.

Loeb has shown that increased alkalinity of the sea water favors cross-fertilizations. In the present case, we should expect an increased acidity due to the accumulation of CO_2 around the unwashed eggs. However, bubbling CO_2 through the sea water did not increase the percentage of cross-fertilizations; possibly the optimum CO_2 tension was not attained. Keeping the eggs for several hours slightly increased the percentage of cross-fertilizations. Sea water in which unfertilized eggs had been kept for 4 to 24 hours (at about 8° C. for the longer periods) gave a slightly higher percentage of cross-fertilizations for fresh eggs than did fresh sea water. It would certainly seem that some substance diffuses from the eggs which favors cross fertilizations and that this is present in effective quantity when the eggs are unwashed and crowded.

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PHOSPHORESCENCE OF HUMAN TEETH

THE fluorescence of teeth is usually intense white with an occasional yellowish or greenish tinge. In older persons the fluorescence shifts into the longer wave-lengths, becoming reddish. Reddish fluorescence is also noted in the teeth of diseased persons.[1] A. H.

[1] J. A. Radley and J. Grant, "Fluorescence Analysis in Ultra-Violet Light." New York: D. van Nostrand Company, Inc., 1939.