Comments and Communications

The Synthesis of Vitamin B_{12} in the Digestive System of the Sheep

Several months ago it occurred to us that a relationship might exist between cobalt deficiency disease in sheep and the fact that vitamin B_{12} contains cobalt (Smith, E. L. *Nature*, Lond., 1948, **162**, 144). Accordingly we fed one sheep 0.4 milligram of cobalt containing radioactive Co^{56}, and a second sheep 1 mg of cobalt containing traced cobalt. On subsequent examination of the feces it was found that more than half of the traced cobalt had been incorporated into an organically bound form. On treatment of the feces with 0.5 *N* HCl almost all the active cobalt could be extracted. On extraction with butanol most of the activity went into the organic solvent in a manner similar to the behavior of B_{12} obtained from liver extracts (*ibid.*, **161**, 638). Tests with inorganic cobalt show that a negligible amount passes into butanol from water solution under these conditions. Biological assay, using both *Lactobacillus lactis* Dorner (Shorb, M. S. *Science*, 1948, **107**, 397), and *Lactobacillus leichmannii*, indicated the presence of large amounts of vitamin B_{12}. Thus, sheep feces appear to be an important source of B_{12}.

We have seen the paper of L. S. Gall *et al.* (*Science*, 1949, **109**, 468), showing that the growth of certain bacteria in rumen of the sheep is stimulated by the administration of cobalt. It is tempting to assume that these rumen bacteria synthesize the B_{12}.

PHILIP H. ABELSON and HUGH H. DARBY

Carnegie Institution of Washington, Washington, D. C.

Scientific Research vs. the Theory of Probabilities

There is an increasing tendency to force use of the theory of probabilities upon those engaged in scientific research. To me, scientific research is the attempt to discover and establish principles for accurate prediction of what will happen. Can we use measurements and the absolute truths of the mathematicians for accurate prediction in human or biological affairs?

To whom should one go for accurate prediction as to how long one will live? Mathematicians deal with this subject by means of the theory of probabilities, and the actuaries they train make the necessary calculations for life insurance companies. For the purposes of these companies one goes to a medical examiner to be classified as to length of life. However satisfactory for the companies these calculations and classifications may be, for the individual case the prediction may seem no better than that made by an astrologer. I was refused life insurance over twenty years ago, and the other day a neighbor was accepted for life insurance in the morning and died going upstairs in the afternoon!

The prestige of mathematics is so great that many persons forget that even in mathematical hands, *probability*, *chance*, and *random* mean ignorance. They come to think that, in the alembic of mathematics, chance in some way becomes certainty. They take great care to select random samples without realizing that, insofar as a sample has been random, they don't know how it was selected.

The biologist's greatest gift from mathematics might well be, not a theory that may delude him into belief that he is wise when he is ignorant, but rather the ideal of clear definition and precise use of his terms and symbols, not excepting *science* and *research*. When we are faced with discrepant results in our handling of facts, four courses are open to us. First, we may gloss over our failure in prediction by saying that the exception proves the rule. Second, we may abandon our principle of prediction and fold our hands. Third, we may hold onto that principle and by piling up results and treating them mathematically try to show accurately, for intellectual satisfaction or for practical action, just how much or how little the principle determines what happens. Scientists who content themselves with testing theories or supposed principles can well use the theory of probabilities and may call this scientific research. To go no further is to abandon the search for new principles that may permit accurate prediction in the individual case.

Finally, we may be stimulated by the discrepancy between our results and our expectations to discover unknown principles; this will be true scientific research. It is to be contrasted with, not assisted by, use of the theory of probabilities. The latter is a most valuable tool for practical action on the basis of current knowledge and current ignorance.

A. G. HUNTSMAN

Department of Zoology, University of Toronto

Name of the Soybean

J. Paclt (*Science*, 1949, **109**, 339) has proposed that the name *Glycine Max* (L.), as used for the soybean, be rejected as having been based on a *nomen confusum* (*Phaseolus Max* L.) and that the name *Glycine Soja* (L.) Sieb. et Zucc. be taken up in its place. Perhaps no plant has been subjected to more nomenclatorial buffeting and name-changing than has the soybean—a situation that always is unfortunate, and the more so for a plant of economic importance. In a more recent extensive accounting for the correct name of this plant I have presented detailed analyses to support the contention that the legitimate name of the soybean is *Glycine* Max (L.) Merrill (Lawrence, G. H. M. *Gentes herbarum*, 1949, 8 fasc. 1.)

The name of the soybean dates from 1753 when, in his