DISCUSSION

SIGNIFICANT FIGURES IN STATISTICAL CONSTANTS

I WISH to commend the note in SCIENCE of September 25, 1936, by Professor Edward B. Roessler on "Significant Figures in Statistical Constants." The general point made is well taken, and the specific authors cited for disapprobation, Fisher and Tippett, are excellent choices. In regard to the number of figures to be retained in a finally published constant, the rule given to retain no figures beyond the position of the first significant figure in the standard error is quite satisfactory. I can not, however, agree with the rest of the rule to the effect that one more place in computations is sufficient. I have not found it so in all cases. Specifically, in obtaining a least-square solution where three or four parameters are to be evaluated, and therefore that number of simultaneous equations solved, I have found it necessary to retain an exceedingly large number of figures after the decimal point, and that if this is not done large errors may result. The errors arise this way: I multiply the equations through by constants to equalize the coefficients and then eliminate by subtraction. If a considerable number of decimal figures are not retained, when one subtracts one may obtain as a coefficient a quantity approaching zero, in which significant figures have been lost. The fifth or sixth decimal figures may become the first significant figure after subtraction. It is hard to know, or at any rate I have not been able to formulate any simple rule by which one can anticipate in advance at just what places it will be important to retain a large number of decimal figures, and I therefore retain routinely six figures after the decimal point, even if this amounts to twelve or more significant figures. This precaution of retaining so many figures, I have found necessary in practice nowhere but in the solution of simultaneous equations; but it is an illustration of the fact that one can not make any general rule that is simple for all calculations.

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NEW LOCALITIES FOR THE BLACK WIDOW SPIDER

To the thirty-six states and British Columbia, Alberta, Manitoba and Ontario from which black widow spiders, *Latrodectus mactans* (Fabr.), have been recorded,[1] H. M. Field adds Wisconsin[2] and L. H. Townsend southern Illinois and Oregon,[3] which tends to complete the picture of the distribution of this much maligned female. During the past four years of collecting spiders in the Chicago area, I have had the opportunity of adding northern Illinois and Indiana to the range. This leaves only eight states (Minnesota, Iowa, Virginia, Delaware, New Jersey, Connecticut, Rhode Island, Vermont) in which the spider has not been officially recorded. All these states will undoubtedly be put on the black list eventually, as they are surrounded on all sides by states which have this pest.

Around Chicago these spiders are fairly common in localized areas. I have found them in piles of cut wood in the Kankakee Dunes area about ten miles south of Momence, Ill. Their characteristic webs, extending up to low shrubs and down to a hollowed-out burrow in the leaf mould, were also found at the Michigan dunes at Lakeside, the Indiana dunes at most any spot from Gary to Michigan City and the Palos Park Forest Preserve in Illinois. Its obscure nest and shy ways in this region keep it well out of most people's ken. Probably this also accounts for the apparent spread in distribution of this species. Added support to this idea that the apparent spread is merely insufficient investigation is the fact that W. J. Gerhard of the Field Museum has specimens collected in 1908 from Palos Park. So far the spider has not been called to the attention of the public by invading homes or by causing bites, though there is no doubt that the spider is to be found within the region and probably in other spots than those in which it has been encountered.

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CONCERNING A NAME FOR BOTTOM MUD FOOD

DR. ROBERT T. MORRIS[1] has asked for a word (derived preferably from the Greek because companion words have been similarly selected) to signify the food supply in top layers of mud at the bottoms of water masses, whether ponds, lakes or oceans, from which numerous species of animals may derive much or all of their nutriment.

Some of us who consider mud-eating forms in studies of the comparative nutrition of marine animals are particularly interested in the adoption of a suitable word for this kind of food.

We are offering for consideration a basic word *"ilytrophon"* (from ἰλύς, mud, slime, + τροφόν, food). Examples wherein the root prefix is already in use to designate dwelling in or other association with mud,

[1] C. E. Burt, *Jour. Kans. Ent. Soc.*, 8: 4, 117, 1935.
[2] H. M. Field, SCIENCE, 83: 2147, 186, February 21, 1936.
[3] L. H. Townsend, SCIENCE, 84: 2183, 392, October 30, 1936.
[1] SCIENCE, 84: 291, 1936.

sludge, slime, silt, bog or sea bottom are: Ilyanthedwardsiidae and Ilyanthus (hexactinarians which live in bottom mud or sand in the Mediterranean Sea); Ilysia, and Ilysiidae (referring to a group of reptiles, coral snakes, which inhabit swamps, etc., in certain warmer countries).[2]

The root "troph-" is familiar to all as signifying nutrition and might well be carried over into the synthesis of the new word.

We speak of autotrophic or heterotrophic nutrition in organisms; we encounter the same root in prefixes both in general physiology and in medicine; such words as trophic, trophoplasm, trophotaxis, trophoneurosis, trophopathy are some examples.

The word *ilytrophon,* signifying the food materials present in mud, ooze, or bottom detritus, would provide natural derivatives such as *ilytroph* (*n*) a mud feeder; *ilytrophic* (*adj.*) designating the nature of either the food or the habit of consuming it or an animal or fauna subsisting upon muddy substrates; *ilytrophism* (*n*) the name of the mud-eating habit.

Although some other root might be selected as a prefix if one wished to more specifically designate mud on the *bottom,* this would only lengthen the word, making it more cumbersome and difficult to use. Also, the Greek word ἰλύς seems already to mean precipitated or bottom mud, slime, etc., since even "Meeresgrund" (sea bottom) is given as one synonym. It would seem consistent to merely qualify the type of ilytrophic material or fauna under discussion by describing it as marine, oceanic, shore, fresh water, etc., as we do with other terms such as plankton. When we offer a word to signify a mud-eater or bottom feeder such as some of the sipunculids[3] most of us think of animals which consume muddy material lying on the floors of puddles, swamps, ponds, lakes or oceans, whether deep or shallow, and not of other organisms, such as lamellibranchs and tunicates, which filter suspended mud from the water. These latter are, after all, plankton feeders, and their ingestion of mud is probably largely only incidental to their feeding upon plankton.[4]

Addendum. Since this note was first submitted, a note by Professor Glover M. Allen (SCIENCE, 84, 374, 1936) has appeared in answer to Dr. Morris' original notice. Professor Allen proposes words also derived from ἰλύς, such as *ilyon, ilyonic* and *ilyobic,* which are shorter terms than ours. We still feel that the use of the suffix *trophon* has the advantage of specifying the type of *food* which nutrifies various mud-eaters, thus applying directly to Dr. Morris' original request.

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BENTHOS, BENTHIC AND "BENTHOTIC"

UNDER the title, "Wanted: A New Word," the author of the article in SCIENCE (84: 291, 1936) appeals for a companion word to planktonic, to use in place of "benthotic," which he cites as being awkward. He further states that "according to the dictionary 'benthos' relates to the bottom of the sea," and that this "is not descriptive in application for the food of many forms of aquatic life living in shallow waters."

The Webster,[1] Standard[2] and Century[3] dictionaries unfortunately define benthos only in the approximate sense above quoted, but use benthic and/or benthonic as its adjectives, and not benthotic. (The term benthal is variously defined by these dictionaries, and for this reason should perhaps be left out of this discussion.)

It is to be regretted that the writer of the previous article in SCIENCE, besides consulting Greek and Latin scholars and the dictionary, as he says he did, had not also turned to biologists and their writings, for benthos and its adjective benthic are well established in the accepted limnological and general hydrobiological literature as designating *all* freshwater bottom-dwellers as well as marine organisms. The two following authorities are cited.

Paul S. Welch, in his "Limnology" (1935), the standard general treatise on limnology in the English language, defines benthos as follows: "The term benthos designates the whole group of bottom-dwelling organisms. Burrowers, clingers, mere crawlers on the bottom, hiders among bottom materials, case or tube forms, sluggish phytophiles, and bottom associates of other kinds compose this group." And further: "It must be understood that the term includes the organisms of the bottom *from the water's edge down to the greatest depths.*"[4]

Academician S. A. Zernov, the Russian hydrobiologist, in his "General Hydrobiology" (1934, in Russian) uses the term benthic (benticheskii) as a synonym of bottom-dwelling and as the adjective of benthos.

If it is a further subdivision of the word benthos that is desired, to cover only "the top layer of mud," then reference should be made to Welch's (*loc. cit.*) comprehensive discussion of the ooze-film assemblage

[2] Zoologisches Wörterbuch, by G. Niemann and H. L. Honigmann. Publ. by A. W. Zickfeldt, Osterwieck am Harz, 1919.

[3] F. Peebles and D. L. Fox, *Bull. Scripps Inst. of Oceanography,* Tech. Ser. Vol. 3, 201–224. Univ. of Calif. Press, 1933.

[4] D. L. Fox *et al.,* Bull. Scripps Inst. of Oceanography, Tech. Ser. Vol. 4, 1–64. Univ. of Calif. Press, 1936.

[1] Webster's New International Dictionary, 2nd ed., 1934.

[2] New Standard Dictionary, 1929.

[3] The New Century Dictionary, edition of 1934.

[4] Italics by the writer.