sponsored jointly by the two institutions, will be directed by Dr. Ephraim A. Speiser, director of the American School of Oriental Research in Baghdad and professor of Semitics at the University of Pennsylvania, who will carry on field work. This is his third season in Mesopotamia. Dr. Speiser sailed for the Near East on September 15, and expects to begin work at Tepe Gawra early in October. Assisting him on the scientific staff will be E. Bartow Muller, architect; Arthur J. Tobler, recorder, and Alfred Bendiner, artist, all of the University of Pennsylvania.

THE London *Times* states that at the general meeting of the British Association for the Advancement of Science the British Science Guild was incorporated with the association. The formation of the guild in 1905, with Lord Haldane as first president, was primarily due to Sir Norman Lockyer. Its aim, which coincides with the policy of the association to lay emphasis on the social implications of science, was to influence public opinion, and to promote closer contact between science on the one hand and social problems and public affairs on the other. The annual lectures associated with the name of Norman Lockyer will be continued by the association. The past work of the guild has been varied, comprising reports on agricultural research, patent law, river pollution, the conservation of national energy resources, etc.

THE residuary estate of the late Mary Gardiner Thompson, who died last April, is left to Columbia University, the Presbyterian and New York Hospitals, the New York Historical Society, the Children's Aid Society and the New York Association for Improving the Condition of the Poor. Each of these institutions receives the sum of $2,201,491.

IN giving his report on the three hundredth anniversary fund of Harvard University, President Conant said that the friends and alumni who have contributed to the fund number 8,881; that they had subscribed $760,954 without restriction, $523,696 specifically for the support of university professorships, $997,685 specifically for the endowment of Harvard national scholarships and $492,636 specifically for the encouragement of work in the physical sciences, a grand total of $2,774,972. He recorded three other gifts. First was that of Lucius N. Littauer, already announced but not yet formally reported, of $2,000,000 for the support of instruction and research in public administration. The second came from the Carnegie Corporation in recognition of the tercentenary and in the interest of dental research and dental education. This was $350,000. Third was a gift of $250,000 received from Mrs. Frances Glessner Lee to establish "The George Burgess Magrath Endowment for Legal Medicine." These and a few minor benefactions made a total of $5,448,192.

PUBLIC institutions will ultimately receive most of the estate of George Blagden, formerly a broker and vice-president of St. Luke's Hospital, New York City, who died in 1934. The estate was valued at $2,510,729 gross and $2,337,118 net, consisting principally of securities. Five institutions will receive cash bequests amounting to $87,500. Upon the death of named beneficiaries, the residuary estate will go to Harvard University and to St. Luke's Hospital, New York City, in equal shares. Bequests made in addition to the residuary estate were: The New York Association for Improving the Condition of the Poor, of which Mr. Blagden was treasurer, $25,000; St. Luke's Hospital, $42,500; Grace Church, $10,000; The National Society for the Prevention of Blindness and the Board of Visitors of the New York State Orthopedic Hospital for Children, $5,000 each.

DISCUSSION

SIGNIFICANT FIGURES IN STATISTICAL CONSTANTS

STATISTICIANS might well follow the lead of the physicists and engineers who, in general, have consistent rules for the retention of significant figures. Statisticians have devised formulae for estimating the standard error and probable error of statistical constants, but no uniformity of practice exists in the retention of significant figures. Not only is much time wasted on computations, due to the retention of more figures than the precision of the data warrants, but results expressed to many decimal places without regard to their precision give a very misleading impression of the accuracy of the results.

The analysis of a large sample in "Statistical Methods for Research Workers" (Fourth Edition, pp. 47–49) by R. A. Fisher is an example. The data, the heights of men, are given to the nearest inch, and the mean of the sample is found to be 68.6435 inches. The standard error is 0.0797 inch. Fisher concludes "from this value it is seen that our sample shows significant aberration from any population whose mean lay outside the limits 68.48 inches to 68.80 inches. It is therefore likely that the mean of the population from which our sample was drawn lay between these limits." Then why not simply find the mean of the sample to be 68.64 inches and the standard error 0.08 inch?

Grouping, which is commonly used to save labor, in itself introduces some error in the result. In the sample above, the loss in the estimation of the standard deviation is 2.28 per cent.; the loss in the estimation of the mean is half as great. This in itself would seem to be good reason not to express the constants to four decimal places.

L. H. C. Tippett in a similar example in "The Methods of Statistics" (pp. 39–41) expresses the mean of a series of 1,078 heights, given to the nearest inch, as 67.6976 inches, with a standard error of 0.082. This is followed by the startling statement that "the constants have been calculated *correct*[1] to several decimal places."

Occasionally some one suggests a rule for significant figures in statistics. Kelley[2] suggested the criterion: "Keep to the place indicated by the first figure of $\frac{1}{2}$ the probable error."

Scarborough in "Numerical Mathematical Analysis" (p. 11) states that the average of 10 or more numbers which are given to n significant figures is usually true to $n+1$ significant figures. Later in the same book he states that if the probable error of the average be large, it is better to express the average to only n significant figures.

A rule generally used in physics and engineering is this[3]: "In all deviation and precision measures retain two, and only two, significant figures. . . . The place of figures corresponding to the *first* significant figure of the deviation measure is somewhat uncertain (from 1 to 9 units), while the place corresponding to the *second* significant figure in the deviation measure is uncertain by ten times this amount (10 to 99 units). Beyond this place the significance of additional figures is so slight as to be of no value."

Since the errors of measurement are ordinarily tremendously greater in biological, economic and social investigations than in physical observations, the retention of more than one doubtful figure in a constant is unjustified. Therefore when final results are published, the second doubtful figure should be dropped and the constants expressed to the figure that corresponds with the first significant figure of their respective precision measures. In all other data, and in computations, retain as many places of figures as correspond to the second place of significant figures in the pertinent deviation or precision measure. Two places of doubtful figures are thus retained so that accumulated errors due to rejections in the course of a computation may not affect the first place of uncertain figures in the result.

Many workers in the social and biological sciences are not mathematicians and use statistical analysis only as a necessary tool. For these, a definite, simple, yet mathematically sound rule is desirable. The writer suggests the following working rule: *In a final published constant retain no figures beyond the position of the first significant figure in the standard error; keep one more place in all computations.*

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[1] Italics by the writer.
[2] SCIENCE, 60: 524, 1924.
[3] H. M. Goodwin, "Precision of Measurements and Graphical Methods," pp. 23–24.

PARAMECIUM MULTIMICRONUCLEATA VS. PARAMECIUM MULTIMICRONUCLEATUM

IN 1910 Powers and Mitchel[1] reported and described a new species of *Paramecium*. Powers speaks of it as a multimicronucleate type: Mitchel calls it *Paramecium multimicronucleata*. Article 14 of the International Rules of Zoological Nomenclature, speaking of specific names, states that adjectives, used as specific names, must agree grammatically with the generic name. *Multimicronucleatum* is used by Mitchel as a descriptive adjective, and since *Paramecium* is a neuter singular noun, the descriptive adjective must also have the neuter singular form.

Landis,[2] Wenrich,[3] Lieberman,[4] King,[5] Giese,[6] Diller,[7] Duodorff,[8] have followed Powers and Mitchel in using *multimicronucleata*. But Hance,[9] Lucas,[10] Stranghöner,[11] Müller,[12] Glaser,[13] Köster,[14] Frisch,[15] Jones[16] and Oliphant[17] use the grammatically correct form, *multimicronucleatum*.

Article 19 of the International Rules of Zoological Nomenclature states that "the original orthography of a name is to be preserved unless an error of transcription, a lapsus calami, or a typographical error is evident." An error of transcription and a typographical error can be ruled out. Can the mistake be called a

[1] J. H. Powers and Cl. Mitchel, *Biol. Bull.*, 19: 324–332, 1910.
[2] E. M. Landis, *Jour. Morph. and Physiol.*, 40: 111–167, 1925.
[3] D. H. Wenrich, *Trans. Amer. Micros. Soc.*, 47: 274–284, 1928.
[4] Paul R. Lieberman, *Trans. Amer. Micros. Soc.*, 48: 1–11, 1929.
[5] Robert L. King, *Jour. Morph.*, 58: 555–564, 1935.
[6] A. C. Giese, *Physiol. Zool.*, 8: 116–125, 1935.
[7] William F. Diller, *Jour. Morph.*, 59: 11–49, 1936.
[8] Michael Duodorff, *Jour. Exp. Zool.*, 72: 369–386, 1936.
[9] R. J. Hance, *Jour. Exp. Zool.*, 23: 287–333, 1917.
[10] Miriam Scott Lucas, *Proc. Soc. Exp. Biol. and Med.*, 27: 258–260, 1930.
[11] E. Stranghöner, *Arch. f. Protistenk.*, 78: 302–360, 1932.
[12] Walter Müller, *Arch. f. Protistenk.*, 78: 361–462, 1932.
[13] R. W. Glaser, *Jour. Parasitol.*, 19: 173, 1932.
[14] Willy Köster, *Arch. f. Protistenk.*, 80: 410–433, 1933.
[15] J. A. Frisch, S.J., SCIENCE, 81 (2109): 537, 1935.
[16] Edgar P. Jones, *Anat. Rec.*, 64: 108–109, 1935.
[17] Joseph F. Oliphant, *Anat. Rec.*, 64: 77, 1935.