it means observed frequency. The value of the statistical constants is simply that they provide a conventional method of summarizing frequencies of observed data. To shift the meaning of probability from observed frequency to predicted frequency is precarious, although we are always attempting it in scientific generalization. However, it takes more than a process of division by the square root of the number of cases—the obtaining of the probable error of the mean—to bridge the gulf between observation and prediction. The lay conviction that the probable error of the mean is actually a prophecy is hard to overcome. That it is not prophetic will become clear to any one who will take the trouble to fractionate a large body of data, compute the probable errors of the means of each fraction and note how they vary, and then compare all these discordant predictions with the actual probable error of the means computed from the array of means. The probable error of the mean is a useful constant since it summarizes the variability of data in relation to their amount; but it is not a key to the future.

All this is negative. Actually what was Dr. Johnstone to do? First, observe and report, I should say; and let him predict who will. Certainly there is no need for much statistics to summarize his twenty cases. He wishes to know the most probable number of bacteria per cc. in this emulsion. Scientifically by the most probable number is meant the most frequent number; and his data show that 6–10 counts were more frequent than any other. Why obscure the simple fact by a statistical superstructure? If now he wishes to risk prediction on the basis of 20 cases, he may say that 6–10 counts will occur more often in his 250 c.c. than any other group, 16–20 counts next most often, 11–15 and 21–25 counts less often, and so on. This course has the simple merit of telling the observed truth and doing very little more.

In predicting the total number of bacteria within the 250 c.c. one must multiply the arithmetic mean of the counts by 250. We have given the distribution of 20 counts and we have no alternative to assuming that it is the most probable distribution of 20 counts. Hence we must take the observed distribution as many times over ($12\frac{1}{2}$ times) as 20 will go into 250 and sum all the frequencies. Dr. Johnstone found 366 bacteria in 20 c.c. The most probable number in 250 c.c. must be $250/20 \times 366 = 4{,}575$. Mr. Michael gets 4,005 by the erroneous assumption that the most probable (most frequent) logarithm is the logarithm of the most probable (most frequent) count, which is plainly impossible since the logarithmic relation is not linear. The illusion arises because we take it for granted that any most probable natural number must be inseparably connected with the most probable logarithm. When we substitute the word "frequent" for "probable" we may see our mistake, for the logarithms of the small numbers are more frequent than the logarithms of the large numbers.[9]

Concerning the general problem of obtaining "the probable error of extremely asymmetrical frequency curves," I would urge that in simple cases it is unnecessary to depart far from the observed facts. Usually one is most interested in the value of the most frequent (most probable) case and in the amount of deviation on either side. The values of the mode and of the upper and lower quartiles give this information, as well as the range within which half the cases have fallen and an indication of the skewness. Except the gift of prophecy, what more could one want?[10]

Edwin G. Boring

Clark University,
Worcester, Mass.

ALBINO VERTEBRATES

In July 1919, on the Beaver River near the mouth of the Dore River in Saskatchewan, I shot a pure albino grackle (*Quiscalus quiscula æneus*). It was a young male, 10.5 inches long, and was associated with a flock of grackles. It seemed much less shy than the

[9] S. Newcomb, *Amer. J. Math.*, 4, 1881, 39 f.

[10] See in general, "The Logic of the Normal Law of Error in Mental Measurement," *Amer. J. Psychol.*, 31, 1920, 1.

rest of the flock. I have sent the damaged skin to the Provincial Museum at Regina.

In the summer of 1915, two living albino specimens of Richardson's spermophile (*Citellus richardsoni*) were sent to this university from near Hanley, Sask. I saw them, but through carelessness they were both lost before further data were obtained.

An albinistic crow of a very light brown shade is among the stuffed birds of the university collection. Beyond the fact that it was taken in Saskatchewan, I have been unable to learn anything about it.

JOHN S. DEXTER
UNIVERSITY OF SASKATCHEWAN

A PLEA FOR MORE EXPLICIT DESIGNATION OF SCIENTIFIC REPRINTS

THE library of the Bureau of Fisheries contains one of the largest, if not the largest, collection of reprints on the subject of aquatic biology. It is the practise of the bureau to make analytical cards of all such separates, copy being furnished the Library of Congress by which the cards are printed. These cards become part of the Library of Congress issue and have world-wide distribution.

That the cards may be used with confidence by those needing them for bibliographical purposes and unable to consult the volumes in which they have appeared, it is necessary that the cards not only show the source of the reprints but also give the place of publication, date, volume, and pagination. Unfortunately separates are frequently devoid of such data. It is astonishing indeed that a great number of reprints are found to be without indication of the year of publication; many give no reference to the journal from which they are reprinted; and nearly all lack mention of the place of publication. Frequently the publication in which the article originally appeared is not available; but even when it is at hand the librarian has no right arbitrarily to give the place of publication of the original as that of the reprint, unless the reprint so states. Difficulty is frequently encountered with reprints which carry only a caption title and bear no date of issue; in such cases, it may be possible to give the date which appears on the title page of the volume (provided the volume is available) but frequently the issue of the volume is antedated by the separate. The date of first publication is of paramount importance in certain instances, as every investigator knows.

The Bureau of Fisheries has endeavored to establish a standard of high efficiency in the bibliographies attached to its publications, and publishes none submitted until they have been fully verified. If all reprints consulted by authors compiled with the simple and obvious requirements of bibliographical reference, much labor would be saved and greater accuracy assured. Under present conditions much time is frequently required, to locate original papers and, failing in this, it is sometimes necessary to return bibliographies to the investigators, only to find that, in some cases, they have seen only the separates and can not therefore authoritatively supply the necessary data.

It is of course of vital interest to investigators that their papers be cited correctly and it is therefore important that every author see to it that his reprints indicate not only the source, but also place, date, volume and pagination. This end could readily be accomplished with the cooperation of editors and publishers of scientific journals, proceedings and transactions of scientific societies, and state and institutional reports and bulletins. The slight additional labor involved would be fully justified by the saving of time and worry of other investigators, librarians and editors, and by the prevention of confusing errors of citation.

ROSE M. MACDONALD
LIBRARIAN, U. S. BUREAU OF FISHERIES,
WASHINGTON, D. C.

SCIENTIFIC BOOKS

Report of the Second Norwegian Arctic Expedition in the "Fram," 1898–1902, 4 volumes in 36 parts, large octavo, 1907–1919, 9 maps, 111 plates, and 2,071 pages of text. Published by the Society of Arts and Sciences of Kristiania (Videnskabs-Selskabet i Kristiania), at the expense of the Fridtjof