and in tireless energy, patience and talent, stand out preeminent in their respective groups. ALBERT MANN

QUOTATIONS

THE BRITISH NATURAL HISTORY MUSEUM

WE learn that there are at present vacancies in the entomological, zoological and geological departments of the Natural History Museum which have been open for several months, and that more vacancies are expected in the immediate future. The museum is one of the great national instruments for the collection, classification, and preservation of specimens of the animal and plants, the rocks and minerals, of the world. For the adequate performance of its duties, it must have a full staff of able and devoted specialists. It should require no defense on utilitarian grounds, for the advancement of natural knowledge of the kind to which it is devoted is recognized as a privilege by every civilized state. But there are plenty of utilitarian arguments. Take entomology alone: the number of living species of insects is estimated at over 2,000,000. The preserver of insect life on human life is continuous. As household pests, as carriers of disease, as enemies of stores or crops, they are every day being found to have an unexpected economic importance. It is to the experts and the collections of the Natural History Museum that we have to turn for the requisite information, and unless the museum has an adequate staff we turn in vain. The difficulty in filling posts with suitable men is partly financial. The present rate of pay for assistants in the second class is from £150 to £300, and in the first class from £300 to £500 a year, with a temporary war bonus. These salaries—the "despair" of Professor Stanley Gardiner, whose cogent letter we publish in another column—are no longer sufficient to attract or to retain men of the right attainments, unless they happen to have private means. The smallness of the staff and its inevitable division into water-tight compartments makes promotion slow and capricious. These disadvantages are increased by an antique privilege of the principal trustee, who nominates candidates for vacancies instead of advertising for them. It has frequently happened in the past that middle-aged mediocrities have been brought in and placed over the heads of the existing staff because of their acquaintance with a group in which some of the trustees are interested. The fact is that the mode of governance of the Natural History Museum is medieval. It should be separated from Bloomsbury and placed under a body of trustees selected not because they make a hobby of collecting bugs or butterflies, but because they have a wide knowledge of the scientific purposes which it is the business of the museum to subserve.—*The London Times.*

SCIENTIFIC BOOKS

Geodesy, including Astronomic Observations, Gravity Measurements and Method of Least Squares. By GEORGE L. HOSMER. John Wiley and Sons. First edition, 1919, 377 pages, 6 × 9, 115 cuts.

This book is especially to be commended for the skill shown in the selection of illustrations, both photographs and drawings, and for the excellence of arrangement and printing of the text and tabular matter. These things contribute substantially to the satisfaction and comfort of the user.

Still more is the book to be commended for its positive qualities, which make it a distinct and valuable addition to that part of the literature of geodesy which serves to carry information and understanding from the extreme specialists who are developing the methods and extending the knowledge in these fields, to the students and the practising engineers who desire to get a well-balanced view of the whole field of geodesy quickly. The old well-known matters are restated well in effective grouping. The ideas, formulæ and tables most needed by the student and the practising engineer are selected from the great mass of available material with rare skill. The recent developments in geodesy are shown in true perspective with respect to old things, to a quite unusual extent for a text-book.

Among the comparative recent developments in geodesy that are especially well stated in the book are (1) the importance of determining the relative strength of different proposed chains of triangulation as fixed by the geometrical relations, and the methods for quickly doing so; (2) the relation between the average length of the lines in a triangulation and the rapidity, economy, and accuracy of that triangulation and its convenience to the user; (3) the advantages of the light and rapidly built towers such as are now used in the Coast and Geodetic Survey; (4) the advantages of the transit micrometer on portable instruments for determining time accurately; (5) the application of the interferometer to determination of the flexure of the support of a pendulum used to determine the relative values of gravity at different points. These things are stated forcefully and with good judgment as to their relation to older ideas and methods.

Though he has looked carefully for errors of omission, the reviewer, who has a background of experience which naturally tends to make him keenly critical, finds only three that are, in his opinion, important.

1. On its best direction theodolites the Coast and Geodetic Survey uses two sets of double parallel lines in the micrometer microscopes with which the horizontal circle is read, the two sets being so placed that the observer moves the micrometer screw only one turn between a forward and the corresponding backward reading, instead of five turns. This is a time-saving convenience which also increases the accuracy, and surely should have been mentioned in the book.

2. The necessity of tracing back the adopted field length of a base measuring tape to the standard meter and the methods of doing so are inadequately treated in the book. The developments of the past twenty years have made it clear that one must concentrate much more keenly on this part of the work than the book indicates.

3. The area method of computing the figure of the earth from geodetic and astronomic observations is barely referred to on page 204 without explanation. In view of the fact that this method gives a much higher degree of accuracy from the same observations than the traditional arc method, it certainly deserves a page of general exposition in the book, even if it is possibly too difficult for the student to grasp in full. The student and the engineer should know that the more accurate method exists, should know its general character, and in a general way why it is more accurate than the arc method.

The author of the book has shown such ability to see with the eye of an expert, and to exercise the judgment of a practicing geodetic engineer, that one may confidently expect that even these three omissions will not occur in a second edition.

JOHN F. HAYFORD

SPECIAL ARTICLES

CONCERNING APPLICATION OF THE PROBABLE ERROR IN CASES OF EXTREMELY ASYMMETRICAL FREQUENCY CURVES

IN a study of the fecal pollution of shellfish, Dr. James Johnstone[1] raises an important question: that of determining the most probable value of a measure from a series whose frequency distribution is highly asymmetrical. In such instances it is evident, although prevailing practise contradicts the statement, that it is illegitimate to apply the probable error in the usual manner. For such application presupposes a symmetrical (Gaussian) distribution, and, since a wide range of biological measurements is characterized by an asymmetrical distribution, the matter merits consideration.

Dr. Johnstone lists the following counts of colonies of bacteria growing on twenty plates, each having been incubated a standard length of time after being inoculated with 1 c.c. of an emulsion, in 250 c.c. of water, of five muscles collected at random from the polluted area: 7, 24, 40, 15, 22, 20, 17, 9, 16, 29, 7, 9, 10, 26, 15, 11, 21, 17, 10, and 41. Dr. Johnstone assumes each count to be an estimate of the number of bacteria per c.c. of the emul-

[1] "The Probable Error of a Bacteriological Analysis," Rept. Lanc. Sea-Fish. Lab., 1919, No. XXVII., p. 64–85.