The formal recognition of Newton's philosophy in 1916 by Professor Krylov's translation is the first definite public recognition history records. During the first one hundred years of the academy's life no English scholar or man of science was honored by membership. Newton was still alive during the first two years of the academy's existence. The translation of Newton's "Principia" by Professor Krylov was made from the fifth edition,[3] as he states, not the third, as Dr. Timoshenko and Dr. Uspensky state. In regard to my mention of the first edition, this is referred to on the title page of the new Russian edition of the "Principia."

Referring to the quotation of Professor Petrunkevitch's statement, I think it would have been much fairer to their national pride not to have reshuffled Professor Petrunkevitch's quotation, taking some part of it and bracketing it into another part, thus giving the reader the wrong impression. My effort was to bring out from this quotation something to the credit of Russian scientific training.

My source for the information concerning Nicholas and Daniel Bernoulli was "Tableau Général . . . dans les Publications de L'Académie Impériale des Sciences de St.-Pétersbourg, 1872," 1st part, pages 408–409. Under the heading of Membres Effectifs, it is stated that both Bernoullis were professors of mathematics in the academy. Nicholas was born in Basel, Switzerland, and Daniel in Groningue (in my paper I stated the latter was from Germany, which was an error.) Daniel did study medicine, but never practiced until after he retired from the academy. Drs. Timoshenko and Uspensky state that Goldbach was never a member of the academy. According to the last reference quoted on page 408 he was a "membre effectif" and was the first "Secrétaire de Conférence de l'Académie."

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SCIENTIFIC BOOKS

ELEMENTARY STATISTICS

Elementary Statistics. By MORRIS BLAIR. xiv + 690 pp., including 98 plates. Henry Holt and Company. 1944.

NEW developments in statistical methods are leaving their impact on pure science, manufacturing development, marketing and business practice, public opinion and government statistics, and accordingly attention is demanded from all branches of science when a new book on statistics appears. To the pure scientist, and to most readers of SCIENCE, their main concern is just what statistical practice has to do with scientific method. It is not realized by pure scientists in general that the statistical method over the past few years has brought about a revolution in the concepts of what is meant by exact sciences. Perhaps the "exact scientists" themselves are not under delusion with regard to what constitutes the so-called "exact sciences," but the delusion is certainly common in other places. Actually there is no such thing as exactness in the sense of exact reproducibility of results. While many scientists may agree with W. O. Willcox in the June issue of the *Journal of the American Society of Agronomy* that the result of an applied force "must be accepted as an absolute value and wholly reproducible under parallel conditions without margin for chance," all will agree that there is a hitch in it; the conditions of trials can not be kept constant, and the statement in practice can not be verified. One must recognize the inherent variability of all measurable phenomena. There is no such thing as constancy of measured results except in the sense of statistical control, a concept introduced by Shewhart in 1926. The concept of exactly reproducible results is now replaced, through the work of Shewhart, by the concept of statistical control or the constant cause system. A constant cause system produces not constant results, but constant variability, in the sense that on the basis of past results produced by the constant cause system, rational and dependable predictions can be made with regard to the proportion of the next 100 or 1,000 observations that will fall within any given pair of limits. In other words, probability theory applies to a phenomenon in a state of statistical control.

The statistician recognizes two kinds of variability: (1) variability that can be eliminated (arising from "assignable" causes), and (2) variability that can not be altered (arising from "chance" causes) without installing a fundamentally new cause system. The second type of variability exhibits statistical control. Whether a state of statistical control exists is decided by use of the control chart and the Shewhart criterion of randomness. As Shewhart states in his book, "The Statistical Method from the Viewpoint of Quality Control" (Graduate School, U. S. Department of Agriculture, 1939) the constant cause system represents the limiting state of knowledge.

Controlled variability is practically all contained within an "error band," which can be calculated from

[3] Sir Isaac Newton's Principia reprinted for Sir William Thomson, LL.D., Glasgow, James Maclehose, Publisher to the University. MDCCCLXXI. 4to. [According to Professor Krylov.]

a series of past observations. Ordinarily, a decrease in the spread of the error band can be attained only at a price. In practical work there is a limit in precision beyond which the precision gained is not worth the additional cost. Part of the statistician's job is to design sample surveys that produce the precision required for the purpose (formulation of action), but no more.

The simplest arrangement of the constant cause system is a smooth bowl in which have been placed physically similar discs on which numbers have been written. Samples drawn blindfolded therefrom with proper care in mixing and replacement will show variability that meets the criterion of statistical control. This variability can not be altered without the introduction of new numbers on the disks. Statistical control can be achieved in manufacturing and in sampling in the social science, though the emphasis must be on the word "achieve." Statistical control is not ordinarily found to exist naturally but requires effort, to which incidentally the work of Shewhart has been largely directed; his methods not only tell when control has been achieved but they help to achieve it.

The book under review can be said to bring the subject of statistical methodology to the reader as it was perfected up to the impact of Shewhart researches. The principles of the newer methods in statistics have appeared in at least one elementary text-book, namely, Colonel Leslie E. Simon's "An Engineers' Manual of Statistical Methods" (Wiley, 1941), and the principles are being put into sampling practise in both government and industry.

In the reviewer's opinion, the science of statistics will rise rapidly in the eyes of the natural scientists when in the future three conditions are met: (1) when it is recognized that the purpose of collecting, compiling and analyzing data is to provide a rational basis for formulating a course of action; (2) when the concept of the constant cause system and the usefulness of the statistical method in detecting assignable causes of variability is recognized; and (3) when the statistician is recognized as an expert in measuring and discovering assignable cause of variability, and in deciding how much precision (how big a sample) is economical.

The author of this book states in one of the prefaces directed to teachers that his product is a result of fifteen years of teaching, and that he has sifted the material very carefully. He states also that the business man and practising statistician will find the text valuable as a reference book. Certainly the author's claims in these respects are admirably fulfilled so far as the book goes. The summary formulas at the end of the book (pp. 624 *ff.*) are extremely handy for reference. The leading questions and references at the end of each chapter will likewise draw appreciation from studnts, teachers and practising statisticians, as well as casual users. The practising statistician must be concerned not only with the science but the art of his subject, and the frequent suggestions for forms or work sheets and tables will be duly appreciated by many users.

What is needed in statistical theory and practice is some arrangement for interchange of talent between universities, government and industry. Some day, sometime, arrangements will be worked out whereby writers having the gift of presentation like Mr. Blair and the enthusiasm to write text-books, can have interneships in government and industrial practise.

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FORESTRY

Forestry on Private Lands in the United States. By CLARENCE F. KORSTIAN, Duke University, School of Forestry, Bulletin 8, June, 1944; 234 pp. 27 figs. Price, paper $1.00; cloth, $1.50.

KORSTIAN'S study of the field of private forestry in the United States constitutes a sincere and impartial investigation of a subject on which little conclusive factual evidence of an authoritative character exists despite its importance in our economic future. Deep public concern has been manifested since the origin of the forestry movement in the '80s and '90s of the last century, over the progressive denudation of virgin forests, with little thought given to their renewal and perpetuation by private owners and operators. Although predictions of an impending timber famine, prevalent before World War I, have failed to materialize with the expected rapidity, due to the unexpected development of substantial quantities of second growth conifers in the vast southern pineries, yet the U. S. Forest Survey has lent no encouragement to the belief that scarcity of wood at an approaching future period will be avoided.

Consequently, public attention has again been focused on the problem of private forest lands, which comprise nearly 73 per cent. of all commercially productive lands, but which are being cut in the proportion of 95 per cent. of the total yield of saw-timber. Are private owners changing their attitude toward their forest holdings and managing them by methods which will insure the reproduction and maintenance of this resource, or is the process of exploitation, liquidation and denudation continuing? If it is, what should be done about it?

Dr. Korstian approaches this question in two ways. His primary purpose is to determine, by a process of sampling, the extent and character of private forest management based on individual initiative. His sec-