

But the detection of the early stages, discrimination between methods of treatment, and determination of the most suitable times and modes of applying these can be adequately pursued only in the field. The work of the professors of entomology and of mycology will be eagerly watched in many parts of the empire, and the men they train will have no difficulty in finding useful spheres when the demands of the West Indian islands have been satisfied.—*The London Times*.

SCIENTIFIC BOOKS

Mathematical Philosophy. A study of fate and freedom. Lectures for educated laymen. By CASSIUS J. KEYSER. Pp. xiv + 466. New York: E. P. Dutton and Company.

The common saying, "What man would be a philosopher who might be a mathematician" does not seem to apply to the author of this book, who tells us in the preface that for more than two score years he has "meditated upon the nature of mathematics, upon its significance in thought, and upon its bearing on human life." The book is in the form of twenty-one lectures designed primarily for students whose major interest is in philosophy but it aims to appeal to a much wider circle of readers, including professional mathematicians and the "growing class of those natural-science students who are interested in the logical structure and the distinctive method of mathematics regarded not only as a powerful instrument for natural science but also and especially as the prototype which every branch of science approximates in proportion as its basal assumptions and concepts become clearly defined."

The last lecture of the book is on science and engineering. In this lecture the author considers various definitions of engineering and then proposes the following: *The science and art of directing the time-binding energies of mankind—the civilizing energies of the world,—to the advancement of the welfare of man.* The language of this definition portrays the type of language used throughout the volume. The reader may at times feel that the language is too flowery to convey much real information,

but he will generally find that the words are far from empty. Even in the more mathematical parts of the book, where the author speaks of the infinite abelian group of angel flights and discusses the question whether mind is a group, will frequently disclose much careful thought in what might at first appear to be superficial statements.

Professor Keyser has for a long time been preeminent among American mathematicians as regards a certain type of popularization and the present volume is perhaps, up to the present time, his most successful effort along this line. The scientist who wishes to acquire a knowledge of the nature and bearing of some of the fundamental mathematical concepts without going deeply into the subject will find here a unique opportunity. It is true that this knowledge is here presented in a sugar-coated form and that there is a danger that some of the readers may not get within this coating, but it is to be hoped that many others will become really interested in the subject matter and will give it sufficient thought to derive a lasting benefit therefrom. Teachers of mathematics will probably find here attractive features of their own subject which had escaped their attention. In fact, the present writer found the lecture devoted to the group concept worthy of a second reading although he had given much thought to this particular concept before reading this lecture.

The book under review occupies a unique and useful place in the mathematical literature of to-day. It deals with a considerable number of fundamental mathematical concepts, including those of transformation, invariance, infinity, hyperspace, group, variable and limit. Considerable attention is given to systems of postulates and the properties which are essential to a genuine system. In particular, it is noted that the Hilbert system of postulates for geometry is not intrinsically superior to others. On page 43 our author refers to the system of postulates "devised by the late Professor Hilbert and found in his famous 'Foundations of Geometry,'" which would naturally be construed to mean that Hilbert died before the publication of this book. This is fortunately not the case.

In the preface to his "Easy Mathematics," 1906, Sir Oliver Lodge stated that "the mathematical ignorance of the average educated person has always been complete and shameless." One cause of this ignorance has been the lack of popular and reliable books dealing with serious mathematical subjects. By the publication of the present volume Professor Keyser has rendered a very notable service towards the supply of such popular books. He has introduced into the book at various places somewhat serious doses of mathematics but these places are probably sufficiently separated by non-mathematical material to hold the reader who would not be interested in a book restricted to real mathematics.

G. A. MILLER

UNIVERSITY OF ILLINOIS

SPECIAL ARTICLES THE "WINTER CYCLE" IN THE FOWL

THE idea of the superimposition of a Mendelian factor or factors determining the egg production of the "winter cycle" upon the factors determining the egg production of the

¹ Harris, J. Arthur: "The Value of Inter-annual Correlations," *Amer. Nat.*, Vol. 49, 707-712, 1915.

² An exhaustive series of correlations for the egg records of the individual months of the first and second year was determined some months ago and is now in press in *Genetics*. The correlations for the total productions of the "cycles" have been only recently determined, because of the difficulty of dealing with the moments of such large numbers without grouping.

normal or "reproductive cycle" has become widely familiar as an explanation of the phenomenon of the inheritance of fecundity in the domestic fowl.

In recent years there has been much skepticism among geneticists concerning the validity of this hypothesis. Crucial evidence for or against it is difficult to obtain.

Some light may be thrown upon the problem by the determination of the correlations between the egg records of the various "cycles" in the first and second laying year. If the birds of a flock differ fundamentally among themselves by reason of the presence in or absence from the zygotes from which they developed of Mendelian genes or factors determining their winter egg production, it would be logical to expect that the highest inter-annual correlation¹ would be that of the winter period. This must be considered true under the theory stated unless the further assumption be made that genes of factors which determine egg production during the "winter cycle" of the first laying year have no influence in determining production during the "winter cycle" of the second laying year.

We have, therefore, determined all possible correlations between the total egg records of the "cycles" of the first and of the second year for a series of 443 White Leghorn birds, for which complete records for the first two laying years are available.²

The correlations appear in the accompanying table. These show that for all four periods considered there is a higher correlation between the records of homologous periods than be-

BIRD'S FIRST YEAR

BIRD'S SECOND YEAR	BIRD'S FIRST YEAR					
	Winter ³	Spring ³	Summer ³	Autumn ³	Annual	
Winter	+ .3225 ± .0301 10.71 ⁴	+ .0680 ± .0335 2.02	+ .1269 ± .0331 3.83	+ .3142 ± .0303 10.36	+ .2955 ± .0307 9.62	
Spring	+ .1177 ± .0332 3.54	+ .3293 ± .0300 10.97	+ .2060 ± .0322 6.39	+ .1874 ± .0325 5.76	+ .2782 ± .0310 8.97	
Summer	+ .0976 ± .0333 2.93	+ .3047 ± .0305 9.99	+ .4272 ± .0275 15.53	+ .2904 ± .0308 9.42	+ .4026 ± .0282 14.27	
Autumn	+ .2535 ± .0315 8.04	+ .0369 ± .0336 1.09	+ .2679 ± .0312 8.58	+ .5545 ± .0233 23.79	+ .4115 ± .0279 14.74	
Annual	+ .3255 ± .0301 10.81	+ .2352 ± .0318 7.39	+ .3641 ± .0292 12.46	+ .5127 ± .0248 20.67	+ .5134 ± .0248 20.70	

³ The conventional limits of these "cycles" are as follows: Winter, November to February; spring, March to May; summer, June to August; autumn, September to October.

⁴ Ratio of correlation coefficient to its probable error.