

the generative nuclei. But is such an interpretation possible? I think not.

On harvesting the plants the grain was found to be badly shrivelled, the Michigan Bronze crosses only producing three grains, none of which germinated. From about three hundred grains of the Rivet and Red King crosses, two hundred and sixty plants were raised. The rust appeared on these as early as March 16, and by June 15 many plants were orange-coloured even on the highest leaves. On counting out the plot, 78 plants were found to be free from disease, 118 were slightly infected, and 64 were badly attacked. By June 29 the epidemic seemed to be at its height, and a second count showed that the number of disease-free plants was reduced to 64, while 195 were infected, for the most part badly.<sup>1</sup>

These figures seem to be too close an approximation to the Mendelian ratio of 1 : 3 to be a mere accident, especially when taken in conjunction with the results of the first generation. The susceptibility of wheat to the attacks of rust is therefore a definite Mendelian character.

If further researches should show that this capacity for resisting the attacks of disease-producing fungi is in reality a tangible characteristic, the plant-breeder, at all events, will have definite lines to go upon in attempting to solve one of our most important agricultural problems, namely, that of producing disease-resisting strains.

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#### PROBABLE ERROR IN VITAL STATISTICS.

A PAPER on "The Degree of Accuracy of Statistical Data," by Mr. Carl C. Engberg, has been published by the University of Nebraska. "This paper," Mr. Engberg tells us, "is written as a protest against the unnecessary refinement of statistical computations as carried out by the biometricians of to-day." Mr. Engberg complains that the more "prominent biometricians" have worked with five or six figures when they might have worked with three or four with equally good results. He illustrates this by comparing Prof. Pearson's work on enteric fever, published in 1894, with a revision of it by himself using only three places of decimals. He considers that the one is as good as the other. He does not, however, apply the test for relative goodness of fit of observation to theory—*Phil. Mag.*, July, 1900—but discards it without examining the analysis by which it is reached, on the basis of a paradox that he has not been able to see through. He appears to dislike the test because if 16,000 observations are distributed in the same proportions in  $n$  groups as 1000 observations the former distribution shows a lower probability for the fit than the latter, if the same curve be used in both cases. This, however, must be right. 16,000 observations should give a result nearer a smooth curve than 1000. The percentage error has been discarded for years by trained biometricians; it was merely a temporary *modus vivendi*.

As to the use of a greater or less number of decimal places, to those who work with mechanical calculators the number is practically indifferent, and to trained computators even a 7 or 10 figure table of logarithms is hardly slower in use than a 4 or 5 figure table. But are the decimal places when reached worth having? Very often not, very often they are. Mr. Engberg seems quite incapable of distinguishing between the two classes of cases. The only means of testing is to consider the probable errors of the results. The theory of the probable errors of the constants of frequency curves was not given until 1898, and it was not possible to say in 1894 how many places of decimals were or were not necessary. Mr. Engberg appears to think that because vital statistics are tabled to one or even four year units, it is impossible to ascertain the values of constants to two or three decimal places of those units. He states, vaguely, that "the constants cannot be more accurate than the data upon which they are based." He might well have asked the American actuaries for their views on this point! Practical men do not work to 6 or 10 figures for the mere pleasure of it, and in the particular case cited by Mr. Engberg—"Makeham's  $c$ "—we have a constant which

<sup>1</sup> One plant overlooked.

has often to be raised to the fiftieth power! Does Mr. Engberg believe that the mean age at death of a population of several millions, classified solely by year of age at death, cannot be found to less than the rough year which is the basis of the grouping?

Mr. Engberg says that his "paper has not been written in a fault-finding spirit by a detractor of the new science of biometry, but by a teacher of the science." It seems a pity that Mr. Engberg should not have studied either the history or literature of the science he is teaching, or, apparently, have received a training in mathematical statistics. In the former case he would have known that the method he suggests on p. 9 has been long in use (*Yule, Proceedings of Royal Statistical Society*, vol. lx., part iv., 1897), and the inner meaning of tables of powers for testing the last column of high moment tables would have been obvious to him. In the latter case he would have made a valid criticism of over-many decimal places by simply showing that they gave results beyond the probable error of the constant involved, or did not improve the goodness of fit as tested by a legitimate method. We are doubtful whether the growing practice of appointing teachers of biometry in the American universities without preliminary training is really helping the science forward. It leads, it is true, to a multitude of biometric papers, but very few of these are of permanent scientific value.

#### UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—On Thursday, November 19, an election took place of great importance in relation to the advancement of the study of mental science in Oxford—that of Dr. W. MacDougall to the readership in psychology founded some years ago by Mr. Wiide. The first reader was Mr. Stout, the well-known editor of *Mind*, who last summer resigned the Oxford appointment for a professorship at St. Andrews. His successor will no doubt follow in Mr. Stout's footsteps, but those who appreciate the value of the experimental method in psychology confidently anticipate that opportunity will now be given for this study in Oxford. Dr. MacDougall has himself approached the subject from the experimental side, and is the author of very important researches on the physiology of the nervous system, among which those relating to the theory of colour vision may be taken as examples. As a member of the Cambridge Anthropological Expedition to Torres Straits and Borneo, he conducted experimental researches on the mental processes of savages, which afford substantial evidence of his power as an investigator. When to this it is added that he is no less a master of the older methods than of the new, and is regarded as a man of power alike by physiologists and by philosophers, the university may well be congratulated on so valuable an accession to its intellectual forces. Against any regret that may be felt that the new reader is not an Oxford man, the fact may be set off that one of the most successful and influential of American experimental psychologists—Prof. Titchener—received his training in both sides of the subject at Oxford.

CAMBRIDGE.—Dr. Hobson, F.R.S., has been appointed the first Stokes lecturer, and Dr. Baker, F.R.S., the first Cayley lecturer, in mathematics.

An Isaac Newton Studentship of 200*l.* a year for three years, for research in astronomy and astronomical physics, will be vacant in the Lent term, 1904. Candidates must be bachelors of arts under twenty-five years of age. Applications are to be sent to the Vice-Chancellor by January 26.

The degree of D.Litt. is to be conferred *honoris causa* on Prof. Théophile Homolle, member of the Institute of France, director of the French School of Athens.

Prof. Woodhead, Mr. J. E. Purvis, Dr. Tatham, Dr. Lane Nottter, and Dr. R. D. Sweeting have been appointed examiners in State medicine for the diploma in public health.

The scheme for the establishment of a geographical school and the institution of a special examination in geography and a diploma in geography will be submitted to Senate for adoption on December 5.