MOUNT HOPE FARM
WILLIAMSTOWN
MASSACHUSETTS

HUBERT D. GOODALE, PH.D.
GENETICIST

August 24,1931.

Dr. R. A. Fisher,
The University of Minnesota,
Minneapolis, Minnesota.

Dear Dr. Fisher:-

Many thanks for your letter of August eighteenth. I am especially glad to have my attention called to the omission of frequencies from the discussion of dominance. If you have noticed any other omissions of this sort, please note them.

Table I is made complete for the benefit of those readers, not professional geneticists, who are likely to consult this paper..

Questions four and five of my letter seem to have been insufficiently explicit, and so I would like your opinion on them again, taking into account the following explanations.

Question four refers to the section on Page 21, called "Average Occurance of the Three Genic Conditions" in which reference is made to certain stable ratios of homozygotes, heterozygotes and recessives, and their bearing on the distribution of a population, the later topic being briefly discussed in the paragraph on page 22 beginning "Statistics show - - - -". It seems possible, at least theoretically, to account for the usual curve of variation on other grounds than the classical explanation. So I would like to know if you see mistakes in my reasoning.

The proposition to which question five relates assumes that the genes for high production are both numerous and dominant, and then proceed, to consider how far the use of a single position for the daughters will lead one astray in the rating of bulls. So far as I can see, a single point is absolutely accurate only when Aa is one half AA. Now if the seventy or seventy-five percent point is right theoretically in what may be called the average or near average case, it is necessary to consider the size of the error introduced by using the fixed point, and so I would like to know if the size of the errors I state are reasonable values.

As a matter of fact we have made use in our computations of a series of points ranging from one tenth to nine tenths. The point that best fits the results of mating a high producing strain with a low producing strain is seven tenths. I can see no justification in attempting to account for the results of the inter-strain matings by heterosis. But I do see that it can be accounted for theoretically, as the result of numerous dominant genes. That is all that I am attempting to do.

Our books are strangely silent on the theoretical behavior of multiple dominant genes as applied to quantitative characters. The classical explanation of non-dominant genes may well be only part of the story and so I think we need to look at the possibilities in multiple dominant genes. By approaching it from the theoretical stand point, we may gain a further insight into the inheritance of quantitative characters. So any errors you may note in my handling of the theoretical aspects of the problem, I should like you to note.

The question of genes that reduce production, that is the low yielding gene is dominant over the high yielding gene, is discussed on page 17.

Please let me know how soon you are leaving so your check may reach you before leaving.

Thus far I have had so many things on hand that I have been unable to give due consideration to your suggestion for rating bulls. I'll get at it later. It looks interesting.

Very truly yours,

H. D. Goodale

"Demerit"

n	$\overline{cpd} = \frac{(n-1)(n+1)}{3n}$	$\overline{wppd}$	$\frac{\overline{wppd}}{\overline{cpd}}$	$Merit = 1 - \frac{\overline{wppd}}{\overline{cpd}}$
1	0	0	0	+1.0
2	.5	1.0	2.00	-1.0
3	.66	1.33+	2.00	-1.0
4	1.25	2.0	1.6	-.6
5	1.60	2.4	1.5	-.5
6	1.94----	3.0	1.5428+	-.5428+
7	2.285+	3.428+	1.5	-.5
8	2.625	4.0	1.5238+	-.5238+
9	2.96296---	4.44----	1.5	-.5
10	3.30	5.0	1.5151---	-.5151
11	3.6363----	5.4545--	1.5	-.5
12	3.97+	6.0	1.5104+	-.5104+

While Merit (i.e. + values) works well, Demerit (negative values) works well for $n = 1, 2$ or 3.

Note: 1. Demerit for each <u>odd number</u> beginning with 5 = -.5,

2. Demerit for each <u>even number</u> above 3, decreases successively.

Problem: (a) What can be done to $M = 1 - \frac{\overline{wppd}}{\overline{cpd}}$ to make <u>Demerit</u> always equal to -1, when $\overline{art.pd.}$ is worst possible?

(b) Or to make $1 - \frac{\overline{wppd}}{\overline{cpd}}$ show an increasing - value for successive values of n?