14 October 1933.

Major L. Darwin, Sc.D.,
Cripps's Corner,
Forest Row,
Sussex.

Dear Major Darwin,

I am glad you liked the lecture. I think the audience enjoyed it, though I do not know if any mathematicians were present to react to what was intended as a stimulus.

Thanks for rousing me about "in every direction"; it is just the kind of statement I might make myself, though I do not suppose your father ever used the phrase except to say that he did not assume this. But, what does it mean, and (that answered) is it a plausible guess?

One thing it might mean is that a ~~enquirer~~ engineer having a full knowledge of the working of the organism and of the process by which it grows, might suggest some physically possible modification, such as that a mouse should have spiral whiskers. Should we say (a) that we should permit this suggestion only provided that he has assured himself that the modification he has in mind could be brought about solely by a redesigning of the collection of genes? Or, imposing a more severe restriction, (b) that it must be brought about by a physically possible substitution of a

single gene, or (c) that the transformation of theold gene A into the required new gene A' must itself be a physically possible process. On the third restriction it might I think be argued that, since all physically possible processes must have a finite probability of occurrence, there is a non-zero mutation rate in all possible directions. Some changes satisfying (b) could I suppose be brought about by a succession of changes satisfying (c) but if some could not, it would be reasonable to say that these are directions in which variation does not take place. Can your father's view be fitted somewhere into this framework?

A priori, I can see no escape from the view that mutation rates must to some extent be effected by environment, since I suppose all organic activities are. Nevertheless, I do not believe that your father would ever have ascribed the greater variability of domesticated races to the effect of their environment on their mutation rates, had he not thought that variations were continually dissipated by blending. His deduction was I think the right one from the wrong premise, though wrong in itself.

Yours sincerely,