

THE CONCEPT OF IDENTITY OF GENES BY DESCENT

OSCAR KEMPTHORNE
IOWA STATE UNIVERSITY

1. Introduction

The idea that the underlying mechanism of inheritance is the transmission according to elementary laws of probability of particulate units was, of course, due to the genius of Mendel. If one of the parents of an individual only has an A gene and an offspring has an A gene, then the A gene of the offspring is a copy of the A gene of the particular parent, and the two A genes are identical by descent. Mendel knew this, even though he did not use precisely these words to express the fact. Early in the rediscovery of Mendel's work, mathematicians or statisticians or biometricians (whatever one wishes to call the individuals) were impressed by the mathematical interest of the Mendelian system. It was realized early, of course, that inbreeding, that is, the mating of related individuals was an important tool for the understanding of genetic phenomena. It, therefore, became necessary to develop some of the theory of inbreeding. Pioneers in this work were Robbins and Jennings. But the great advance was made by Sewall Wright [7], who, it appears to me, singlehandedly developed the method of path coefficients to enable the answering of many important questions of inbreeding. The magnitude of Wright's contribution stuns my imagination. It is true that much of his work was algebraic computation and this any one could do. But the erection of a framework for the computations was a great intellectual feat. It would not, however, be stretching the history to say that to most of the world the method of path coefficients was a mystique, obviously very powerful in the hands of its inventor, but quite obscure to many others. Perhaps the cornerstone of Wright's work was the coefficient of correlation of uniting gametes or the coefficient of inbreeding F and Wright developed knowledge of the progress of F with various systems of inbreeding.

It appears to be the great contribution of Malécot [5] to put the Wright ideas into a form which was more readily understood and communicable, by introducing the ideas of genes being alike by descent and by considering inbreeding purely as a matter of probability of genes being identical by descent. To fix the ideas, let a diploid individual X have two genes a, b at a locus. Then,

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