GENETIC DIVERSITY AND DIVERSITY OF ENVIRONMENTS

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1. Introduction

Like many ignorants, I have my deep respect for mathematics tinged with a kind of superstitious awe. Using their recondite, and to me inscrutable methods, mathematicians reach conclusions about problems of genetics and evolution, which I must humbly accept as following inexorably from the premises and the assumptions made. I hope, however, I am not being impertinent if I say that not all of these conclusions are always convincing. The difficulty stems from the premises and the assumptions. Most exasperating is the habit of certain mathematical geneticists who make their assumptions implicit rather than explicit, on the ground that to them the truth of their assumptions seems self-evident. I have accepted the kind invitation of Professor Neyman to participate in this Symposium with reluctance, because of my ignorance of mathematics; all I can talk about are certain self-evident, and certain not so self-evident, biological premises and assumptions.

Let us restrict our attention to Mendelian populations. Mendelian populations are reproductive communities of sexual and either obligatorily or at least facultatively cross fertilizing organisms. This leaves out of account the asexual, exclusively self-fertilizing, parthenogenetic organisms, as well as some intermediate situations in which cross fertilization is rare. A Mendelian population is said to have a corporate genotype or gene pool. The gene pool of a population may be envisaged as the genes in the array of the gametes, sex cells, which give rise to the following generation. The composition of the gene pool can be described in terms of the numbers or of the frequencies of the genes and linked gene complexes. The mechanisms of the replication of the hereditary materials tend to make the gene pool constant generation after generation. Mutation, recombination, selection, sampling errors in small populations, vicissitudes of the environments, and variations of the reproductive habits and opportunities are liable to change the composition of the gene pool.

2. The classical model

Let us begin with a model which is probably the simplest, thoroughly unrealistic biologically, tractable mathematically, and, therefore, the favorite with some mathematical geneticists and genetical mathematicians. Assume a Men-