

EVOLUTION BY MUTATION¹

H. J. MULLER

It is not possible for me to represent the high tradition of Josiah Willard Gibbs by offering you a mathematical treatment. Nevertheless, the subject of biological evolution and its mechanism must be of great interest to yourselves, as the most exemplary products of its operation. Perhaps, then, our reconnaissance flight over these biological jungles, and our attempts to measure certain aspects of them, may serve to entice some of you or, through you, some of those with whom your influence counts, into bringing your higher powered mental tools to bear in the more effective and more elegant mapping and analysis of this territory. If so, my intention to inveigle you into it will have been successfully accomplished.

To those philosophers who declare "I think, therefore I am," their own existence seems the one complete certainty. To others, it does not seem so certain that they do think, nor even that they produce a significant imprint on reality in general. It is, however, evident that they, along with all things living, if they do exist, are utter improbabilities, far less plausible than any other phenomena that have been encountered.

Herein we shall attempt to assess how fantastically unlikely we and our fellow creatures are, and by what means such preposterous anomalies could have come about. The old-time philosopher still insists that such extravagances of organization could have arisen only by design, inasmuch as accident cannot be expected to convert itself into order. However, a dispassionate examination of the rules of this game of life should throw some light on the question of how such a massive compounding of improbabilities may have taken place.

1. The genetic alphabet. Studies in Mendelian heredity, supplemented by microscopic observations, gave evidence some half century ago that at the core of our being, and of that of every living thing, there is a remarkable material, that is particulate, exceedingly constant in its parts, subject to orderly mosaic rearrangements, and in a sense self-multiplying. All this was shown by the kaleidoscopic, yet statistically predictable effects it gave on being transmitted and

The thirty-first Josiah Willard Gibbs Lecture, delivered at Cincinnati, Ohio, on January 28, 1958, under the auspices of the American Mathematical Society; received by the editors March 14, 1958.

¹ This article is Contribution No. 649 of the Department of Zoology, Indiana University.