

HERMANN JOSEPH MULLER

was born in New York City on December 21, 1890. His grandparents on his father's side were of artisan and professional background and, though at first Catholics, had emigrated from the Rhineland during the wave of reaction of 1848 to seek the greater freedom of America. His father, born in New York, had continued the grandfather's art metal works (the first in the U. S. A.), but was not by inclination a business man, and, although he died in 1900, he early awoke in the boy a lively interest in the nature of the universe and in the process of evolution, as well as in the welfare of men in general. The boy's mother, Frances Lyons Muller, had also been born in New York City. Her parents had come from Britain, but were in the main descended from Spanish and Portuguese Jews who, as an after-effect of the Inquisition, had settled generations earlier in England and Ireland. She, as well as the father, encouraged in the boy a broad sympathy, an interest in living things, and a love of nature.

He was brought up in Harlem, first attending public school there and later Morris High School (also public) in the Bronx. There he and his classmates LESTER THOMPSON and EDGAR ALTENBURG founded what was perhaps the first high-school science club. Though his family (mother, sister Ada and himself) had very limited means, they were fortunate in usually being able to spend their summers in the country while he was of school age. But he was enabled to attend a first class college--Columbia--only through the unexpected award of a scholarship (the Cooper-Hewitt), automatically granted to him in 1907 on the basis of entrance examination grades. He spent his summers, during his college years, at such jobs as bank runner and hotel clerk (the latter at \$25 a month, plus board, for a 14-hour work-day).

At Columbia College he was before the end of his first year fascinated by the subject of biology. Reading by himself in the summer of 1908 R. H. LOCK'S (1906) book on genetics, his interests became centered in that field. Courses soon afterwards taken under E. B. WILSON influenced him profoundly, as did also his reading, independently of courses, of works by JACQUES LOEB and by other writers on experimental biology and physiology. In 1909 he founded a students' biology club, which was participated in, among others, by ALTENBURG, and by two students, BRIDGES and STURTEVANT, who had entered Columbia a year later.

For his first two years of graduate work, since there was no opening offered him in zoology, he managed to obtain a scholarship ('10--'11) and then a teaching fellowship ('11--'12) in physiology, the latter at Cornell Medical College, while keeping up with genetics on the side and doing various extra jobs, such as teaching English to foreigners in night school. Finally, however, he obtained a teaching assistantship in zoology at Columbia ('12--'15). The first summer ('11) of graduate work was spent in studies at Woods Hole, the rest in laboratory teaching at Columbia. During these five years he was seriously overworked. In all this period he was chiefly interested in the *Drosophila* work which MORGAN had opened up, and from 1910 on he closely followed this research and was an intimate member of the group, although he did not have opportunity for much experimental work of his own on this material until 1912. Then he was able to begin his investigation of the simultaneous interrelationships of many linked genes, which supported the theory of crossing over and constituted his thesis. At the same time he undertook his analysis of variable, multiple-factor, characters by means of the device of "marker genes". This extended the validity both of chromosomal inheritance and of gene stability, and led later (1916) to his theory of balanced lethals.

Called to the Rice Institute, Houston, as instructor, by JULIAN HUXLEY, he taught varied biological courses ('15--'18), and began studies on mutation. During this time and the two years following, when he was again at Columbia ('18--'20), now as instructor, he elaborated methods for quantitative mutation study. ALTENBURG, who had meanwhile moved to the Rice Institute, and he, partly in collaboration, obtained the first results in this field ('18--'19), including evidence that made probable an effect of temperature. He then ('20) returned to Texas, this time to the University, at Austin, as associate professor, and from '25 on as professor, teaching mainly genetics and evolution, and doing research mainly on mutation. He formulated in 1918, '20, '21, and '26 the chief principles of spontaneous gene mutation as now recognized, including those of most mutations being detrimental and recessive, and being points effects of ultramicroscopic physico-chemical accidents arising in the course of random molecular motions (thermal agitation). At the same time he put forward the conception of the gene as constituting the basis of life, as well as of evolution, by virtue of its possessing the property of reproducing its own changes, and he represented this phenomenon as the cardinal problem of living matter.

In late 1926 he obtained critical evidence of the abundant production of gene mutations and chromosome changes by x-rays (published '27). This opened the door to numerous researches, many of them carried on with the aid of students and co-workers, both at his own and other institutions, in the twenty years that followed. These have been briefly outlined in his accompanying Nobel lecture, since they, together with the first discovery of the effect, constitute the work for which the Nobel award was granted. They include studies on the mechanisms of the gene mutation effects and of the structural changes, on the roles which each kind of changes, when spontaneously occurring, play in evolution, and on the properties of genes and of chromosome parts (e. g. eu- versus hetero-chromatin), as disclosed by studies in which the chromosomes were broken and rearranged.

This later work was carried on at a succession of places. In 1932 he was awarded a Guggenheim fellowship and for a year worked at OSCAR VOGT'S institute in Berlin, in TIMOFEEFF'S department of genetics. At the request of N. I. VAVILOV, he then spent $3\frac{1}{2}$ years as Senior Geneticist at the Institute of Genetics of the Academy of Sciences of the U. S. S. R., first in Leningrad, later ('34--'37) in Moscow, with a considerable staff of co-workers. With the rise of the LYSENKO anti-genetics movement, he moved to the Institute of Animal Genetics, University of Edinburgh ('37--'40); here numerous graduate students, largely from India, took part. Then, from '40 to '45, he did both teaching and research at Amherst College being professor ad interim there from '42 to '45. At Amherst he completed a large-scale experiment showing the relationship of ageing to spontaneous mutations. Finally, in 1945, he accepted a professorship in the Zoology Department at Indiana University, Bloomington, Indiana. Here he is again devoting his time chiefly to work on radiation-induced mutations.