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MILISLAV DEMEREC

1895—1966

A Biographical Memoir by
BENTLEY GLASS

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Biographical Memoir

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M. Demirel.

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January 11, 1895–April 12, 1966

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IN THE YEAR, 1919, when a certain young Yugoslav agricultural student came to Cornell University to pursue graduate study in genetics under R. A. Emerson, the first great decade of American genetical studies was just drawing to a close. The ensuing four and a half decades, to the time of his death, have been identified with Milislav Demerec's own career and contributions as with few others. He was among the dozen or so geneticists whose work has made the United States preeminent in this biological science. His own contributions reflected not only great profundity in seizing upon the most important problems for investigation but also great flexibility in shifting from one area of significance to another, at the cost of abandoning tried techniques and acquiring skill in entirely new ones. Yet equally important to the advancement of science, along with his investigations and discoveries, were his gifts of scientific leadership and administration. No account of his life must ignore their value.

Milislav Demerec was born in Kostajnica, Yugoslavia, on January 11, 1895. He graduated from the College of Agriculture, Krizevci, Yugoslavia, in 1916 and held a position as Adjunct at the Krizevci Experiment Station until 1919, when he came to the United States to study at Cornell University. He received the Ph.D. degree in genetics from Cornell in 1923,

having worked as assistant in plant breeding during several years of his graduate study. In 1923 he joined the staff of the Department of Genetics, Carnegie Institution of Washington, in Cold Spring Harbor, New York, as a Resident Investigator. He was appointed Assistant Director in 1936, Acting Director in 1942, and Director in 1943. From 1941 he was also Director of the neighboring Biological Laboratory of the Long Island Biological Association, which was later renamed the Cold Spring Harbor Laboratory of Quantitative Biology.

On June 30, 1960, Dr. Demerec retired from the directorship of the Department of Genetics of the Carnegie Institution of Washington, and joined the research staff of the Brookhaven National Laboratory as a Senior Staff Member. There he continued his program of research in bacterial genetics until the end of 1965. He then became Research Professor of Biology at C. W. Post College of Long Island University, and remained very active in research until his sudden death from a heart attack on April 12, 1966. A number of posthumous papers, completed by his colleagues, represent work actively in progress at the time.

He has twice been honored since his death, first by C. W. Post College, which named its science building the Milislav Demerec Science Laboratory; and most recently by the Cold Spring Harbor Laboratory of Quantitative Biology and the Carnegie Institution of Washington, which on June 5, 1968, jointly named in his honor the principal laboratory building constructed by the Carnegie Institution of Washington on the land of the Cold Spring Harbor Laboratory (held by the Wawepex Society).

Dr. Demerec held appointments as Research Associate of Columbia University (1943-1965), Consultant of the Brookhaven National Laboratory (since 1948), Visiting Professor at the Rockefeller Institute of Medical Research (1958-1960), and Consultant in Genetics and Cellular Biology at Adelphi

College. Besides giving lectures and seminars in many parts of the United States, Europe, Asia, Africa, and South America, he was instrumental in bringing numerous young foreign scientists and students to the United States to receive experience and instruction in methods of research developed here.

Dr. Demerec was a member of the Council of the 6th International Congress of Genetics, held in Ithaca in 1932; vice president of the 7th Congress, held in Edinburgh in 1939; member of the Permanent International Committee of the International Genetics Congress, 1939-1953; chairman of the Committee on Transportation for the 8th Congress, held in Stockholm in 1948; and a member of both the Organizing Committee and the Program Committee for the 10th Congress, held in Montreal in 1958. He served as secretary-treasurer (1935-1938), vice president (1938), and president (1939) of the Genetics Society of America; as treasurer (1933-1935), vice president (1947), and president (1954) of the American Society of Naturalists; as chairman of the U.S.A. National Committee of the International Union of Biological Sciences; and as member or chairman of many committees appointed by the National Academy of Sciences to study special problems of national and scientific importance. In particular, he served on the Committee on the Genetic Effects of Atomic Radiation, which made important reports in 1956 and 1960. He was chairman of the Section of Zoology and Anatomy of the Academy from 1958 to 1961.

Dr. Demerec was a member of the National Academy of Sciences (elected in 1946) and of the American Philosophical Society (elected in 1952). He was a fellow of the American Academy of Arts and Sciences, the New York Academy of Sciences, and the American Association for the Advancement of Science; a member of the council of the Radiation Research Society; and a member of many other professional organizations, including Sigma Xi, Phi Kappa Phi, the Society of American

Bacteriologists, the Society for the Study of Evolution, the American Genetic Association, the American Society of Zoologists, and the Botanical Society of America. He was honored for his scientific accomplishments by being awarded the Order of St. Sava by the Yugoslav government in 1935, and by honorary memberships in the Royal Danish Academy of Sciences and Letters, the British Genetical Society, the Academy of Sciences of Yugoslavia, the Genetics Society of Japan, the Society of Biology of Santiago, Chile, and the Faculty of Medicine of the University of Chile. In 1957 he received from Hofstra College the honorary degree of Doctor of Laws; in 1960 the degree of Doctor *honoris causa* from the University of Zagreb; and in 1961 the degree of Doctor of Science from Long Island University.

Dr. Demerec became a naturalized citizen of the United States in 1931. In 1921 he married Mary Alexander Ziegler, engineering graduate of Cornell University and teacher of science. Dr. and Mrs. Demerec had two daughters who have survived him, Mrs. Philip E. Hartman and Mrs. Neville Dyson-Hudson, both of Baltimore, Maryland; and five grandchildren.

Dr. Demerec's research spanned a period of forty-six years, and was directed toward a better understanding of the nature of genes, their structure and function, and their spontaneous and induced mutability. Demerec began his genetic investigations with a study of the basis of variable phenotypic traits. The striping of leaves, the variegations of maize seeds, and the virescence of seedlings that at first are albino but later turn green evoked in him a deep interest in the basis of somatic mosaicism. Suspecting somatic mutation to be a prevalent cause of such changes, he very early directed attention to this phenomenon, and shifted from maize to *Drosophila virilis* and to delphiniums as appropriate organisms for probing the nature of the factors that control mutation rates. His classic pa-

pers on the unstable genes of *Drosophila virilis* remain basic to an understanding of the mutation process. These genes exhibited different mutation rates at different stages of the life cycle and in different tissues.

A second period in Demerec's genetic investigations began in the early 1930s with the study of X-ray-induced mutations and deficiencies in *Drosophila*. Here, too, an interest in the role of gene mutation in ontogeny was evident, since one of his most important early contributions to this new area was the relation of induced deficiencies to cell lethality. With the introduction of salivary gland chromosome analysis, the work on deficiencies and other types of chromosome aberrations advanced rapidly, in collaboration first with Margaret Hoover, and later with B. P. Kaufmann, Eileen Sutton, and others. Demerec's interest in the factors controlling spontaneous mutability was not lost, however. From this period date also those extremely significant studies of the differences in mutability in various wild-type strains of *Drosophila melanogaster*, and the identification of a mutability-stimulating gene in the Florida stock.

By the 1940s Demerec was studying the effects of ultraviolet radiation and of neutrons in inducing gene mutations and chromosome aberrations, but the advent of World War II, with certain practical demands, brought about a shift of activity in his laboratory at Cold Spring Harbor. Of enormous practical importance was the work performed to induce, in *Penicillium*, mutations that greatly increased the yield of penicillin. Of greater long-range value were the parallel studies of mutations evoking resistance on the part of *Staphylococcus* to penicillin and other antibiotic agents or to drugs. A major new direction of genetics was initiated by Demerec and Ugo Fano in their 1945 paper on bacteriophage-resistant mutants in *Escherichia coli*. By the end of the 1940s *Drosophila* studies had been fully replaced by studies of radiations and chemical mu-

tagens (including carcinogens) and their effects on the genes of bacteria, especially in relation to mutations promoting bacterial resistance. The latter research revealed two important principles to be followed in antibiotics therapy. These drugs should be administered in high enough initial doses to prevent the occurrence of "second-step" (highly) resistant bacterial mutants; and they should be used in combination rather than singly, since a mutant that is resistant to one antibiotic has a very small chance of being resistant to another one also. This work in turn led, in the 1950s, to the studies that were to occupy Demerec until the end, namely, the investigation of recombination and the fine structure of the gene in *Salmonella*, the agent causing mouse typhoid.

By special techniques of transduction and hybridization, Demerec analyzed various genes that control the synthesis of amino acids and purines in *Salmonella*. Independently, and in collaboration with Philip Hartman and others, Demerec analyzed the functional organization of the bacterial chromosome and discovered a remarkable parallelism between the sequence of functional units and the sequence of biochemical steps in a chainlike synthesis. It became evident that the gene is a complex structure, rather than the basic unit of heredity as was formerly supposed. Smaller units, or mutational sites, can be distinguished within it, and their relative positions determined. It appears that these sites, too, tend to be grouped together according to similarity of function.

Aside from his earliest scientific studies while a graduate student, and his years following retirement, which were spent at the Brookhaven National Laboratory and at C. W. Post College, all of Demerec's long career was identified with Cold Spring Harbor, from that first day in 1923 when he arrived as a fresh Ph.D. to join the staff of the Department of Genetics of the Carnegie Institution of Washington, to the day in 1960 when he retired as Director of both the Carnegie Institution's

Department of Genetics and the Long Island Biological Laboratory. In that span of nearly forty years of activity, Demerec had made Cold Spring Harbor a worldwide focus of inspiration and leadership in genetics. This role began when he became Director of the Biological Laboratory in 1941, and in the following year Acting Director of the Carnegie Institution's Department of Genetics. In 1943 he became the Director of the Carnegie Department, and the close and fruitful collaboration of the two neighboring biological institutions started them toward the fusion that eventually took place. The outstanding series of Cold Spring Harbor Symposia in Quantitative Biology which he organized from 1941 to 1960 brought scientists from all over the world to engage in relaxed, informal conversations on the sandspit and the veranda of Blackford Hall, as well as in the formal sessions where interesting and sometimes epochal papers were presented and discussed. From 1941, when the symposium on "Genes and Chromosomes" was held, until the year of his retirement, it was chiefly the foresight and wisdom of Milislav Demerec in choosing subjects of most timely interest, selecting participants of worldwide eminence, organizing the program, and editing the proceedings that made Cold Spring Harbor in June the mecca of genetic biology, where genetics, evolution, and biochemistry came together in fruitful interaction.*

Stimulating contacts spread through the summer as visiting research workers exchanged ideas with each other and with members of the permanent staffs of the Biological Laboratory and the Carnegie Department. At least one visitor can testify that he never worked harder than during those summers and never had a better vacation for himself and his family than in those years when Cold Spring Harbor was a summer

* It is characteristic of Demerec's innate modesty that he did not list these volumes in his bibliography, but in simple justice this has been done by the author of the present memoir.

home and laboratory. By judicious appointments to the research staffs of the two institutions, Demerec kept the spearheads of investigation probing into significant new fields. Especially noteworthy was the arrival of A. D. Hershey in 1950. Cold Spring Harbor had already become at that date a center of the phage group. Summer meetings had led in 1945 to the establishment of a special summer course for instruction in the theory and techniques of genetic investigation with bacterial viruses. A parallel summer course in the genetics of bacteria was started in 1955. These and later additions to the summer courses have added undying importance to Cold Spring Harbor as a biological center, for here germinated much of the work that flowered in the present effulgence of microbial and viral genetics throughout the world.

Somehow, year after year, Demerec made this possible on a financial shoestring. The Carnegie Institution provided not only new laboratories for its own staff but also a grant to the Biological Laboratory for the construction of a handsome auditorium suitable for future Cold Spring Harbor symposia and other summer meetings. Grants were obtained to support the permanent staff of the Biological Laboratory and the summer courses, and to maintain the charming but ancient buildings. Year after year local friends of the Cold Spring Harbor community were encouraged to help maintain the Laboratory through their gifts. The scientific community throughout the United States was canvassed. In mysterious ways, and with real courage, for two decades Demerec found the means not only to keep the summer programs and the year-round research going, but to expand them in significant directions of the new molecular biology that was springing into being.

Demerec served the scientific community in many ways. In addition to the large number of scientific organizations, congresses, and committees he aided, his editorial activities were very great. He was responsible for the publication of the *Cold*

Spring Harbor Symposia on Quantitative Biology. In 1934 he started *Drosophila Information Service*. This was the first of the professional newsletters and information services in genetics. He established the *Drosophila* stock center at Cold Spring Harbor in the Carnegie Department of Genetics, the first of such stock centers to maintain the important experimental stocks of *Drosophila* and to supply them to *Drosophila* workers around the world. He edited a basic handbook for *Drosophila*, *The Biology of Drosophila*. Together with B. P. Kaufmann, he wrote the *Drosophila Guide*, a handbook of enormous usefulness to all geneticists and other workers with that exemplary organism. The booklet has gone through seven editions. Demerec founded the series *Advances in Genetics* (Academic Press) and served as editor for nine volumes, from 1947 through 1958; he also served on the editorial boards of several genetical journals. Yet in the end those of us who knew him well will remember him as the characteristic spirit and impulse of Cold Spring Harbor, a nerve center of modern genetics.

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KEY TO ABBREVIATIONS

Am. J. Bot. = American Journal of Botany

Am. Naturalist = American Naturalist

Anat. Record = Anatomical Record

Carnegie Inst. Wash. Publ. = Carnegie Institution of Washington Publication

Carnegie Inst. Wash. Year Book = Carnegie Institution of Washington Year Book

Cold Spring Harbor Symp. Quant. Biol. = Cold Spring Harbor Symposium on Quantitative Biology

J. Bacteriol. = Journal of Bacteriology

J. Heredity = Journal of Heredity

Microb. Genet. Bull. = Microbial Genetics Bulletin

Proc. Internat. Congr. Genet. = Proceedings of the International Congress of Genetics

Proc. Nat. Acad. Sci. = Proceedings of the National Academy of Sciences

Records Genet. Soc. Am. = Records of the Genetics Society of America

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