Name: Barbara McClintock

Born: Hartford, Connecticut, June 16, 1902

Secondary Education: Erasmus Hall High School, Brooklyn, N.Y.

Earned Degrees: B.S., Cornell University, 1923
M.A., " " 1925
Ph.D., " " 1927

Honorary Doctor of Science:

University of Rochester, 1947
Western College, 1949
Smith College, 1957
University of Missouri, 1968

Awards:

Achievement Award, Association of University Women, 1947
Merit Award, Botanical Society of America, 1957
Kimber Medal, National Academy of Sciences, 1967
National Medal of Science, 1970

Positions Held:

Instructor in Botany, Cornell University, 1927-1931
Fellow, National Research Council, 1931-1933
Fellow, Guggenheim Foundation, 1933-1934
Research Associate, Cornell University, 1934-1936
Assistant Professor, University of Missouri, 1936-1941
Staff Member, Carnegie Institution of Washington, 1941-1967
Distinguished Service Member, Carnegie Institution of Washington, 1967 to present.
Andrew D. White Professor-at-Large, Cornell University, 1965 to present.

Professional Societies:

AAAS (Fellow)
American Academy of Arts and Sciences
American Philosophical Society
American Society of Naturalists
Botanical Society of America
Genetics Society of America (Vice-President, 1939; President, 1945)
National Academy of Sciences
Sigma Xi

1964

BARBARA McCLINTOCK: STATEMENT OF ACHIEVEMENTS

When Barbara McClintock began her graduate work at Cornell in the middle 1920's the foundations of maize genetics had been firmly laid but comparatively little cytological work had been done. Maize was considered to be so poorly suited for cytological study that the head of a famous genetics laboratory forsook maize for Nicotiana in the mistaken belief that the latter was more favorable material for genetic research.

McClintock arrived in the scientific arena at a propitious time. The carmine smear technique, which greatly facilitated cytological studies, had just been developed by Belling. She quickly found that carmine smears of maize sporocytes at midprophase of meiosis yielded preparations of extraordinary beauty and clarity. Maize could now be used for detailed cytogenetic analyses of a kind heretofore impossible with any organism and McClintock in the succeeding years published a series of remarkable papers which clearly established her as the foremost investigator in cytogenetics. Her first major contribution was the demonstration that the chromosomes were individually recognizable by their relative lengths and arm ratios, distinctive chromomere patterns, and deep-staining knobs in characteristic positions. This was followed by such significant studies as the analysis of translocation heterozygotes, the correlation of cytological and genetical crossing over, the assignment of linkage groups to specific chromosomes, the physical location of gene loci by deficiencies, the formation of dicentric bridges and acentric fragments as a result of crossing over in inversion heterozygotes, the somatic and meiotic behavior of unstable ring chromosomes, the occurrence of nonhomologous pairing, the structure and function of the nucleolar organizing region, the production of viable homozygous deficiencies that simulated gene mutation and formed a pseudoallelic series, and the genetic and cytological consequences of the bridge-breakage-fusion cycle. Her current studies on the evolutionary history of races of maize

as disclosed by the number and location of specific chromosome knobs have been conducted with typical precision and elegance. Among McClintock's outstanding contributions is her analysis of the control of gene action in maize and the discovery of the two-unit interacting system. This concept was the precursor of the regulator-operon theory of gene regulation that won for its promulgators, Jacob and Monod, the Nobel Prize in 1965. Her finding that the transposition of controlling elements from one chromosomal location to another was accompanied by a change in gene action afforded a new and revolutionary insight into chromosome structure and genic expression. Genetics would not occupy its present high estate were it not for her magnificent and pioneering contributions.

Her consummate skill and versatility as a cytologist are perhaps best evidenced by the fact that in the few weeks she devoted to Neurospora there resulted what remains more than twenty years later as the definitive paper on the meiotic chromosomes of this fungus. So difficult cytologically is Neurospora that not even the correct chromosome number was known prior to her studies.

An indication of the significance of her contributions to the present fabric of genetic theory may be had from the number of times her discoveries are specifically mentioned in several recent general texts. As a rule, in such books only the pioneering, the truly significant and illuminating discoveries - the milestones - are cited. The record shows that her work is discussed 15 times in Strickberger, 26 times in Swanson, 10 times in Herskowitz, 8 times in Srb, Owen and Edgar, and 18 times in Lewis and John.

One of the remarkable things about Barbara McClintock's surpassingly beautiful investigations is that they came solely from her own labors. Without technical help of any kind she has by virtue of her boundless energy, her

complete devotion to science, her originality and ingenuity, and her quick and high intelligence made a series of significant discoveries unparalleled in the history of cytogenetics. A skilled experimentalist, a master at interpreting cytological detail, a brilliant theoretician, she has had an illuminating and pervasive role in the development of cytology and genetics.

Biography of Barbara McClintock

America's most distinguished cytogeneticist, Barbara McClintock, was born in Hartford, Connecticut on June 16, 1902. After attending high school in New York City, she enrolled at Cornell University in 1919 and from this institution received the B. S. degree in 1923, the M. A. in 1925, and the Ph. D. in 1927. She served as a graduate assistant in the Department of Botany from 1924-27 and in 1927, following completion of her graduate studies, was appointed an Instructor, a post she held until 1931. Dr. McClintock was awarded a National Research Council fellowship in 1931 and spent two years as a fellow at the California Institute of Technology. In 1933 she received a Guggenheim Fellowship which enabled her to spend a year abroad at Freiburg. She returned to the States and to the Department of Plant Breeding at Cornell in 1934. She left Cornell in 1936 to accept an Assistant Professorship in the Department of Botany at the University of Missouri. In 1941 she joined the staff of the Carnegie Institution of Washington, and began a happy and fruitful association which has continued to the present time. She is currently a Staff Member of the Carnegie's Genetics Research Unit at Cold Spring Harbor, Long Island, New York. McClintock was appointed Andrew D. White professor-at-large at Cornell in 1965, a fitting recognition by her Alma Mater of the great distinction she has achieved as a scientist and scholar.

Barbara McClintock was awarded the honorary Doctor of Science degree by the University of Rochester in 1947, by Western College in 1949, and by Smith College in 1958. She was the recipient in 1947 of the Achievement Award of the American Association of University Women, was given the Award of Merit by the Botanical Society of America in 1957 and most recently (1967) was selected by the National Academy of Sciences for the Kimber Award in Genetics.

McClintock has been for many years a member of the National Academy of Sciences and of the American Philosophical Society, as well as a member of numerous professional organizations. She was elected Vice President of the Genetics Society of America in 1939 and President in 1945. As Special Consultant to the Rockefeller Foundation she has in recent years been instrumental in advancing the training of geneticists in several Latin American countries.

Selected List of Publications of Barbara McClintock

Beadle, G. W. and B. McClintock. A genic disturbance of meiosis in Zea mays. Science 68: 433. 1928.

McClintock, B. A cytological and genetical study of triploid maize. Genetics 14: 180-222. 1929.

McClintock, B. Chromosome morphology in Zea mays. Science 69: 629. 1929.

McClintock, B. A method for making aceto-carmin smears permanent. Stain Technology 4: 53-56. 1929.

McClintock, B. A cytological demonstration of the location of an interchange between two non-homologous chromosomes of Zea mays. Proc. Nat. Acad. Sci. 16: 791-796. 1930.

Creighton, H. B. and B. McClintock. A correlation of cytological and genetical crossing over in Zea mays. Proc. Nat. Acad. Sci. 17: 492-497. 1931.

McClintock, B. and H. E. Hill. The cytological identification of the chromosome associated with the R-G linkage group in Zea mays. Genetics 16: 175-190. 1931.

McClintock, B. The order of the genes C, Sh and Wx in Zea mays with reference to a cytologically known point in the chromosome. Proc. Nat. Acad. Sci. 17: 485-491. 1931.

McClintock, B. Cytological observation of deficiencies involving known genes, translocations and an inversion in Zea mays. Missouri Agr. Expt. Sta. Research Bull. 163: 1-30. 1931.

McClintock, B. A correlation of ring-shaped chromosomes with variegation in Zea mays. Proc. Nat. Acad. Sci. 18: 677-681. 1932.

McClintock, B. The association of non-homologous parts of chromosomes in the mid-prophase of meiosis in Zea mays. Zeitschrift fur Zellforschung und mikroskopische Anatomie 19: 191-237. 1933.

McClintock, B. The relation of a particular chromosomal element to the development of the nucleoli in Zea mays. Zeitschrift fur Zellforschung und Mikroskopische Anatomie 21: 294-328. 1934.

Rhoades, M. M. and B. McClintock. The cytogenetics of maize. Botanical Review 1: 292-325. 1935.

McClintock, B. The production of maize plants mosaic for homozygous deficiencies: Simulation of the bm_1 phenotype through loss of the Bm_1 locus. Genetics 22: 200. 1937.

McClintock, B. A method for detecting potential mutations of a specific chromosomal region. Genetics 23: 159. 1938.

McClintock, B. The production of homozygous deficient tissues with mutant characteristics by means of the aberrant mitotic behavior of ring-shaped chromosomes. Genetics 23: 315-376. 1938.

McClintock, B. The fusion of broken ends of sister half-chromatids following chromatid breakage at meiotic anaphases. Missouri Agr. Expt. Sta. Research Bull. 290: 1-48. 1938.

McClintock, B. The behavior in successive nuclear divisions of a chromosome broken at meiosis. Proc. Nat. Acad. Sci. 25: 405-416. 1939.

McClintock, B. The stability of broken ends of chromosomes in Zea mays. Genetics 26: 234-282. 1941.

McClintock, B. The associations of mutants with homozygous deficiencies in Zea mays. Genetics 26: 542-571. 1941.

McClintock, B. Spontaneous alterations in chromosome size and form in Zea mays. Cold Spring Harbor Symposia Quant. Biol. 9: 72-80. 1941.

McClintock, B. Maize Genetics. Carnegie Institution of Washington Year Book 41: 181-186. 1942.

McClintock, B. The fusion of broken ends of chromosomes following nuclear fusion. Proc. Nat. Acad. Sci. 28: 458-463. 1942.

McClintock, B. Maize Genetics. Carnegie Institution of Washington Year Book 42: 148-152. 1943.

McClintock, B. Maize Genetics. Carnegie Institution of Washington Year Book 43: 127-135. 1944.

McClintock, B. The relation of homozygous deficiencies to mutations and allelic series in maize. Genetics 29: 478-502. 1944.

McClintock, B. Neurospora. I. Preliminary observations of the chromosomes of Neurospora crassa. Am. J. Botany 32: 671-678. 1945.

McClintock, B. Cytogenetic studies of maize and Neurospora. Carnegie Institution of Washington Year Book 44: 108-112. 1945.

McClintock, B. Maize Genetics. Carnegie Institution of Washington Year Book 45: 176-186. 1946.

McClintock, B. Cytogenetic studies of maize and Neurospora. Carnegie Institution of Washington Year Book 46: 146-152. 1947.

McClintock, B. Mutable loci in maize. Carnegie Institution of Washington Year Book 47: 155-169. 1948.

McClintock, B. Mutable loci in maize. Carnegie Institution of Washington Year Book 48: 142-154. 1949.

McClintock, B. The origin and behavior of mutable loci in maize. Proc. Nat. Acad. Sci. 36: 344-355. 1950.

McClintock, B. Mutable loci in maize. Carnegie Institution of Washington Year Book 49: 157-167. 1950.

McClintock, B. Chromosome organization and genic expression. Cold Spring Harbor Symposia Quant. Biol. 16: 13-47. 1951.

McClintock, B. Mutable loci in maize. Carnegie Institution of Washington Year Book 50: 174-181. 1951.

McClintock, B. Mutable loci in maize. Carnegie Institution of Washington Year Book 51: 212-219. 1952.

McClintock, B. Mutation in maize. Carnegie Institution of Washington Year Book 52: 227-237. 1953.

McClintock, B. Induction of instability at selected loci in maize. Genetics 38: 579-599. 1953.

McClintock, B. Mutations in maize and chromosomal aberrations in Neurospora. Carnegie Institution of Washington Year Book 53: 254-260. 1954.

McClintock, B. Controlled mutation in maize. Carnegie Institution of Washington Year Book 54: 245-255. 1955.

McClintock, B. Mutation in maize. Carnegie Institution of Washington Year Book 55: 323-332.

McClintock, B. Controlling elements and the gene. Cold Spring Harbor Symposia Quant. Biol. 21: 197-216. 1956.

McClintock, B. Intranuclear systems controlling gene action and mutation. Brookhaven Symposia in Biology 8: 58-74. 1956.

McClintock, B. Genetic and cytological studies of maize. Carnegie Institution of Washington Year Book 56: 393-401. 1957.

McClintock, B. The suppressor-mutator system of control of gene action in maize. Carnegie Institution of Washington Year Book 57: 415-429. 1958.

McClintock, B. Genetic and cytological studies of maize. Carnegie Institution of Washington Year Book 58: 452-456. 1959

McClintock, B. Chromosome constitutions of Mexican and Guatemalan races of maize. Carnegie Institution of Washington Year Book 59: 461-472. 1960.

McClintock, B. Further studies of the suppressor-mutator system of control of gene action in maize. Carnegie Institution of Washington Year Book 60: 469-476. 1961.

McClintock, B. Some parallels between gene control systems in maize and in bacteria. American Naturalist 95: 265-277. 1961.

McClintock, B. Topographical relations between elements of control systems in maize. Carnegie Institution of Washington Year Book 61: 448-461. 1962.

McClintock, B. Further studies of gene-control systems in maize. Carnegie institution of Washington Year Book 62: 486-493. 1963.

McClintock, B. Aspects of gene regulation in maize. Carnegie Institution of Washington Year Book 63: 592-601. 1964.

McClintock, B. The control of gene action in maize. Brookhaven Symposia in Biology 18: 162-184. 1965.

McClintock, B. Components of action of the regulators Spm and Ac. Carnegie Institution of Washington Year Book 64: 527-536. 1965.

McClintock, B. Regulation of pattern of gene expression by controlling elements in maize. Carnegie Institution of Washington Year Book 65: 568-578. 1966.

McClintock, B. The states of a gene locus in maize. Carnegie Institution of Washington Year Book 66: 664-672. 1967.

McClintock, B. Genetic systems regulating gene expression during development. Developmental Biology Suppl. 1: 84-112. 1967.