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WILLIAM BLOOM

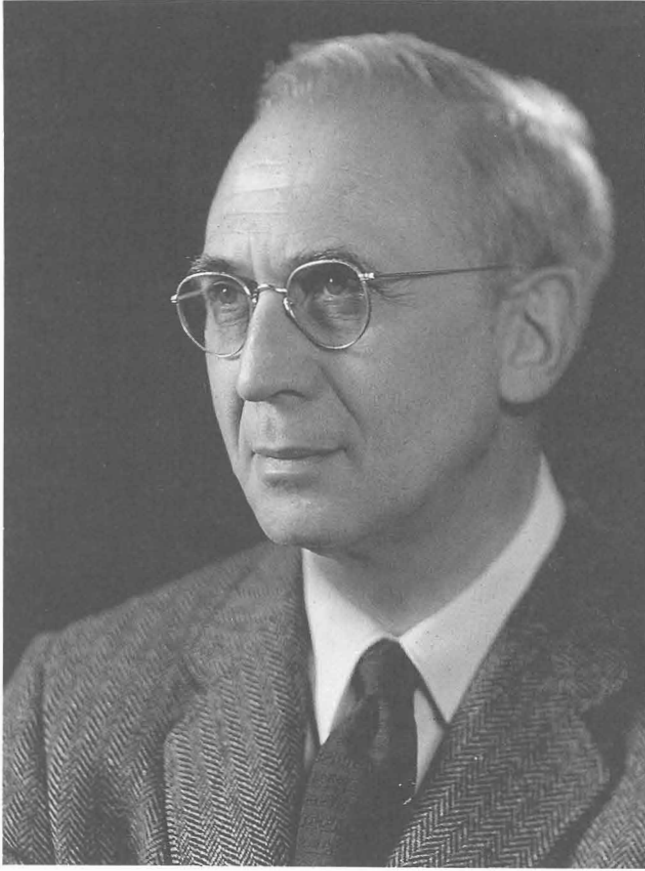
1899—1972

A Biographical Memoir by
RONALD SINGER

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Biographical Memoir

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William Bloom

WILLIAM BLOOM

September 15, 1899–May 11, 1972

BY RONALD SINGER

WILLIAM (“BILL”) BLOOM was born in Baltimore, Maryland, on September 15, 1899, the eldest of the four children of Mayer and Bertha Singer Bloom. Both parents had emigrated from Lithuania in the 1880s, settling in Baltimore—Mayer Bloom at the age of 17, Bertha Singer as a child of 8, accompanying her parents and brothers. Mayer established a wholesale business in women’s clothing, and both he and his wife were interested in civic affairs and were active in the Jewish community of Baltimore. Typically, they had a high regard for learning and a great love of books, traits which they transmitted to all of their children. In fact, by the time Bill was fifteen, his father had given him the right to charge any book he wanted from any store in Baltimore. Bill’s brother, Benson, received an M.D. degree from Johns Hopkins and became a practicing physician in the Southwest, while his other brother, Frank, was a lawyer for the National Labor Relations Board in Washington, D.C. Their sister, Sophia, obtained a Ph.D. from the School of Social Service Administration at the University of Chicago.

Bill attended the Friends School, Baltimore City College (a municipal high school), and the Johns Hopkins University. Following brief service in the U.S. Army (Students’

Army Training Corps) in World War I, he returned to Hopkins, where he received his A.B. degree in 1919 and M.D. in 1923. In his first year of college there were three books which, he said, greatly influenced his thinking, namely, Huxley's *Man's Place in Nature*, Haeckel's *The Riddle of the Universe* and Moore's *The Literature of the Old Testament*; the first two were largely responsible for his electing biology courses in college, while the third was his first acquaintance with a critical interpretation of the Bible and "finished the last tenuous vestiges of organized religion in me." However, in later life he never denied or tried to hide his religious ancestry. I recall a conversation with him in the early 1960s when we were discussing prejudice, particularly antisemitism in academia; Bill noted that he believed he was the first Jew to be appointed chairman in an American anatomy department.

Bill Bloom enjoyed his college years. His interest in and mastery of both French and English literature prompted the instructor in each to encourage him to major in that subject and continue to graduate school. However, it was the introductory course in biology in his second year, taught by Professor E. A. Andrews, that provided the determining factor for the course of Bill's life as far as his field of endeavor was concerned. This was the first instructor he encountered who made students think and question. In the comparative anatomy course the following year, Andrews showed the students material, provided some pertinent facts, and left them to draw their own conclusions. Andrews encouraged Bill to use the department's photomicrographic apparatus, and in 1918 he offered Bill a summer fellowship to work at Cold Spring Harbor, but he could not accept as he had to go to Plattsburg for the Reserve Officers' Training Corps. Before graduating, Bill told Professor Andrews that he wished to study for a Ph.D. in biology, but Andrews

advised him (and others) that there were very few opportunities in research in biology but there were more in medical schools. In the fall of 1919 Bill entered the Johns Hopkins University Medical School.

In the first semester, Bloom was impressed by Professor Florence Sabin's histology course, which comprised laboratory work mainly and a total of eight lectures on scientists and their work. At least two of these were to play important roles in his later development. The first lecture was on connective tissue and Alexander A. Maximow, who, Sabin announced, was the greatest histologist in modern times, but "he had died in the Russian Revolution of 1917." One of Bloom's most treasured letters was that from Dr. Sabin in 1930 (then at the Rockefeller Institute for Medical Research) in which she thanked him for the copy of the first edition of *Textbook of Histology*. She recalled her first lecture of 1919 and stated that "it is clear no one can afford to be without [the textbook]" and "you are certainly to be congratulated tremendously on this very beautiful text of histology, which combines all of Maximow's splendid grasp of the subject . . . with your own experience which you have gained through association with such a master." The second scientist mentioned in the course was Robert R. Bensley, also of the University of Chicago. Sabin distributed some of Bensley's slides on mitochondria, stating that if he had done nothing else but work on the pancreas he would have been a great scientist. Later, he provided the "open sesame" to the Department of Anatomy at the University of Chicago, of which he was chairman and which was probably one of the greatest departments of anatomy during the 1930s and 1940s.

During that first year Bloom pondered on and discussed with various faculty members some research problems, but none came to fruition. That summer he injected rats with

various drugs and trained them to run in Watson's maze for Dr. D. I. Macht, a lecturer in Professor Abel's Department of Pharmacology. Macht used the data in several papers and in a number of preliminary notes on work in which Bloom was mentioned as the junior author. However, what Bloom relished most that summer were the daily luncheons in the laboratory with Abel and his staff; discussions ranged over all sorts of topics from current events, to great and not-so-great books in world literature, to items of science. Abel wanted Bloom to take over the full-time work that Father Roca, who had to return to Spain, had started with Abel on histamine-like substances in the pituitary stalk and hypothalamus. But in those days medical students did not drop out of school for a while to do research, and so Abel asked Bloom to come back when he completed the M.D.

In his second year, Bloom began his first independent research to test his idea that histamine might be the cause of inflammation. He worked in the pathology laboratory of Dr. Arnold Rich, and he published his negative results in the *Johns Hopkins Hospital Bulletin* (34:165-88, 1922). In the summer of 1921 Bloom went to Europe on a cattleboat with Alan and Manfred Guttmacher. They visited a number of renowned professors in medical institutes and clinics in Germany and France. Bloom particularly enjoyed pursuing his interest in the history of science, and he purchased nearly 600 old scientific books and journals, such as by Semmelweiss, Laennec, Corvisart, Bidloo, Morgagni, and Hunter, the most valuable of which he later gave to libraries (e.g., Crerar Library, University of Chicago libraries, and Einstein Medical School in New York).

Although his third year in medical school consisted largely of lectures, clinics, and dispensaries every day, Bloom managed to do some research on experimental adhesions

of peritoneum in dogs. That summer he worked as a substitute intern in medicine, obstetrics, and surgery at Michael Reese Hospital in Chicago. Little did he realize then that most of his life would be spent in that city.

At the beginning of Bloom's fourth year, Dr. Rich returned from Eppinger's laboratory in Vienna and busied himself with work on jaundice. He suggested that Bloom should repeat experiments on the old problem of the route of absorption of bile pigments from the liver in early obstructive jaundice, using the new Van den Bergh test for bilirubin. Bloom also added the use of Eppinger's stain of bile capillaries to see if they ruptured in this condition. He found an unequivocal increase in bilirubin in the lymphocytes long before it increased in the blood and also that the bile capillaries were not ruptured (*Johns Hopkins Hospital Bulletin* 34:316-20, 1923).

After graduation in 1923, Bloom went to Chicago as the first resident pathologist of the Michael Reese Hospital under Dr. O. T. Schultz, who Bloom considered excellent, especially in microscopic diagnosis. Bloom performed many autopsies, did much surgical pathology, and continued experiments on obstructive jaundice. While comparing bilirubin in the blood with blood levels of phenol-tetrachlorophtholein (*Archives of Internal Medicine*, 1924), he found a new method for measuring the latter in blood serum containing much hemoglobin. During the next two years he worked out the early stages of the embryogenesis of human bile capillaries (*American Journal of Anatomy*, 1926) and completed a long paper on the histopathology of Gaucher's and Niemann's diseases (*American Journal of Pathology*, 1925) based on two cases of the former and three of the latter. Also, with Ms. Kern, he analyzed lipids extracted from the spleens of the latter and described these findings in some detail along with

the histochemistry of the lipids (*Archives of Internal Medicine*, 1927).

Bloom showed his slides of embryonic bile capillaries to Dr. G. Bartelmez at the University of Chicago, who suggested that Maximow would undoubtedly like to see them. Bloom later described the meeting with Maximow as the most exciting encounter with a scientist he had ever had. Two weeks later Bloom phoned for an appointment to show him histological and cytological changes in the lipid storage diseases he had studied. Maximow spent four hours examining the sections (even forgoing his routine afternoon stroll), and, when he was leaving, Bloom asked if he could work with him. At first Maximow refused, but when Bloom offered to do a Ph.D. under him, he was advised to discuss it with Bensley. The latter indicated that Bloom did not need a Ph.D. if he had an M.D. from Hopkins, and he suggested that Bloom should register for one course in research in anatomy. He was also warned that Maximow was an unbelievably hard taskmaster.

Some months later Bloom was called home because his father was terminally ill. When he returned to Chicago two weeks later he had decided that he could not do effective research under the primitive conditions and equipment at Michael Reese. Maximow offered him the Douglas Smith Fellowship and provided space in his laboratory with a new microtome and a new microscope. Bloom resigned from Reese to the annoyance of Schultz, who had counted on Bloom being his successor.

Bloom's introduction to experimental hematology resulted in the publication of "Transformation of Small Lymphocytes into Myelocytes in Germinal Centers" (*Folia Haematologica* 33, 1926). Then he began tissue culture experiments with immune reactions (*Archives of Pathology* 3, 1927) and also work on lymphocytes of the thoracic duct, extensive stud-

ies on the origin of monocytes, and further papers on lipid tissues.

Until this time, the two greatest influences in Bloom's scientific development had been E. A. Andrews and J. J. Abel. Then came almost four years with Maximow (February 5, 1925, until his death on December 4, 1928), who taught him many rudiments of laboratory technology. This experience and his subsequent association with Robert R. Bensley and C. Judson Herrick in the Anatomy Department exposed Bloom to three of the foremost histologists of the time.

In 1929 Bloom was appointed assistant professor of anatomy, then associate professor in 1933, professor in 1941, and the Charles H. Swift Distinguished Service Professor in 1957. He served as chairman of the Department of Anatomy from 1941 to 1946. He was also a member of the Institute of Radiobiology, 1946-54, and a member of the Committee on Biophysics (later the Department of Biophysics, in the establishment of which he played a major role), 1954-69. He assumed emeritus status in 1965 and retired in 1969.

Dr. Bloom was also a member of the Executive Committee of the American Association of Anatomists, 1946-50, and served as vice-president, 1952-54. He was a member of the National Academy of Sciences, the American Society of Experimental Pathologists, and the American Society of Cell Biology and was a founding member of the International Society of Cell Biology. He was one of three Americans awarded honorary doctoral degrees at the 600th anniversary of the Jagellonian University, Cracow, Poland, in 1964.

When Bloom began to work with Maximow, the latter was the leading proponent of the unitarian theory of the origin of blood cells, which held that all types of blood cells derive from a common stem cell that he identified as

the lymphocyte. The circulating small lymphocyte of the blood was considered to be a hemopoietic stem cell (hemocytoblast) in a resting condition. Under certain conditions after migration into the tissues, the small lymphocyte was believed to hypertrophy to form a large lymphocyte or hematocytoblast, which, in turn, was capable of giving rise to the precursors of erythrocytes, granular leukocytes, and megakaryocytes. At that time American hematology was dominated by dualistic or polyphyletic theories of hemopoiesis, which insisted that there is no common totipotential "stem cell" but that the erythrocytes and leukocytes came from distinct precursor or stem cells and that the lymphocyte was a fully differentiated cell with no potentiality for further development except into plasma cells. This school of thought was led by Florence Sabin and her co-workers at the Johns Hopkins School of Medicine. Despite Bloom's exposure to the latter during his student years, he rapidly gained a great admiration for Maximow's technical skills and his deep insight into the relationship of cells of the blood to those of the connective tissues. Bloom's first paper on the hemopoietic potency of the small lymphocyte was followed by a series of penetrating studies on the origin and nature of the monocyte and on the behavior of lymphoid and blood-forming organs in tissue culture. These studies strengthened his conviction as to the multiple developmental potentialities of the lymphocyte. With the untimely death of Maximow at the age of fifty-four, Bloom became the principal advocate of the unitarian theory, and he rapidly gained an international reputation in morphological hematology. His investigations promulgating and extending Maximow's views were presented in *Handbuch der Allgemeinen Hamatologie* in 1932 and Downey's *Handbook of Hematology* in 1938 (see Selected Bibliography). He had a profound influence

upon clinical hematology through both his writings and his students.

Bloom was critical of the almost exclusive reliance of many investigators upon dry smears and insisted that no single technique was sufficient—and, indeed, that the sum of all the techniques then available was insufficient to answer the central questions of morphological histology. In his own work, he made skillful use of the light microscope and selective stains for observations on living and fixed cells. By experimental induction of inflammatory reactions and of extramedullary hemopoiesis, he took advantage of pathological conditions to shed light on the normal origins of cells and their potentialities for transformation to other cell types. His belief that lymphocytes can transform into macrophages and into fibroblasts has not been validated, but some of the central tenets of the unitarian concept have withstood the test of time. Now some fifty years later, the capacity of small lymphocytes when stimulated by lectin or antigen to undergo hypertrophy and proliferate has been clearly demonstrated, and its significance for the immune response has been established. The development from single stem cells of spleen colonies containing both erythro- and myelopoietic cells has firmly established the validity of the unitarian concept of hemopoiesis. Bloom's observations in experimental embryology and pathology contributed to an understanding of the origin, structure, and function of the blood-forming tissues, which he summated in *Physiological Reviews* in 1937.

In the 1930s, Bloom collaborated with William H. Taliaferro in studying inflammatory and cellular immune reactions in monkey and avian malaria. With Clay G. Huff he described the hemopoietic cells of canaries infected with a malarial parasite. With George W. Bartelmez he reported on the embryogenesis of the blood cells of the human yolk sac.

During this same decade William and Margaret Bloom collaborated with Franklin G. McLean, carrying out extensive studies on bone and its development, many in egg-laying birds. They were the first to demonstrate the importance of estrogens in laying down of bone minerals in bone metabolism. They recorded the transformation of osteoblasts into osteoclasts. Bloom also performed many experiments with Morris Kharasch, the most interesting of which turned out to be on iron and manganese catalysis and bacterial growth and the production of pigments in bacteria by varying the types of aldehydes and ketones in the growth media. For several years he worked with Percival Bailey and Roy Grinker; with the former he cultured brain tumors and with Grinker he studied experimental aseptic inflammation in the brain.

At the time of his death, Maximow was writing a textbook on histology. A few chapters had been completed, but many were in rough manuscript or still in Russian. His colleagues in the Department of Anatomy "felt very keenly the desirability of seeing the book completed," and, at the suggestion of Bensley, Bloom undertook the unenviable task. The details of how this was done are presented in the preface of the first edition of the now famous Maximow and Bloom's *Textbook of Histology*, as well as in the insightful paper by John L. Dusseau in *Perspectives in Biology and Medicine* (30:108-16, 1986). After seven English editions, Bloom was joined by Professor Don W. Fawcett, the distinguished anatomist and cytologist of Harvard University, for the eighth and ninth editions of this authoritative reference. It has been translated into many languages, including Spanish, Portuguese, and Korean. Subsequent editions have been rewritten in part and edited by Fawcett only.

During World War II, under the auspices of the Committee on Medical Research, Bloom collaborated in testing

the effects of vesicant war gases on animals and men and the effectiveness of protective ointments and clothing. Commander J. Troxel acted as his liaison at the Glenview Naval Station. Later in the war, working on the Metallurgical Project under the Manhattan District, Bloom assembled a research team to assess the biological effects of irradiation. Their findings were published (with Bloom as editor) after the war (1948) as volume 22-I of the National Nuclear Energy Series, titled *Histopathology of Irradiation from External and Internal Sources*.

After the war, Bloom collaborated with Raymond E. Zirkle in examining the effects on dividing cells of irradiation with a proton microbeam. Changes in the cells were followed by means of phase-contrast microscopy and recorded in time-lapse motion pictures. This study of the mitotic process in newt fibroblasts in tissue culture and the effect of focal irradiation (using an ultraviolet microbeam) of parts of chromosomes or the spindle was subsequently extended to electron microscopic analysis of changes in individual cells that had previously been irradiated. Bloom's last publication (1970) described electron microscopic observations of unirradiated mesothelial cells throughout the mitotic cycle in vitro.

In his rough autobiographical notes, Bloom proudly states, "No account of my last 40 years' work would be complete without consideration of the contribution of my wife who has worked devotedly on many problems with me in the laboratory and has also helped me with the books and many of the papers which I have written." In addition to several publications of her own, Bloom's wife, Margaret, shared responsibility for carrying out and reporting a number of experiments.

Margaret Abt was born in Chicago in 1898, the daughter of Solomon Lincoln and Clara Abt (nee Hirsh). Margaret

first met Bill in 1923 (shortly after his arrival in Chicago) in the home of a cousin who had been his classmate at Johns Hopkins. She was working toward her Ph.D. in home economics and had taken a histology course taught by Maximow, as well as a physiology course. She became interested in Bill's work and began assisting him in his laboratory. Then she dropped the idea of finishing her Ph.D. They were married in 1928.

During the 1930s, Bloom and the physiologist Ralph Gerard were instrumental in revising the medical curriculum at the University of Chicago, pioneering the provision of an elective quarter for freshmen to stimulate research interests. Bloom had great awareness of the significance of the physical sciences for biology. He was a consultant to the Argonne National Laboratory, and he played an important part in establishing biophysics as a discipline at the university. He was known as a master teacher, for his unexcelled knowledge of his subject and for his insistence on painstaking work in a lifetime of teaching at the university. Bloom placed great emphasis on laboratory teaching in his courses, and the student loan collection of slides covered most of the sources of the illustrations in his text. The students were personally taught to look for the source of the textbook statement and not to have it found for them in kodachromes.

Bloom directed the research of many young scientists on whom his meticulous techniques, incisive thinking, and broad scholarship had lasting effects. His graduate students included Roscoe McKinney, Clayton Loosli, Leo Clemente, Raymond Murray, Matthew Block, Eleanor Conway, and Minnie Heller. In addition, dozens of medical students worked laboriously in his laboratory, while many postdoctoral fellows and colleagues from many parts of the world carried out investigations under his guidance in his laboratory.

Bloom was able to rescue several anatomists and their families from Hitler's Europe by procuring funds or positions for them in the United States. Among them was Franz Weidenreich, gross anatomist, histologist, and physical anthropologist (famed for his discoveries of and research on the so-called Peking Man fossils), who Bloom stated was "one of a few great men of the older generation whom I had the privilege of knowing intimately." He brought Fritz Wasserman from Germany to teach gross anatomy and Peter De Bruyn from Holland to teach histology in the Department of Anatomy.

Bloom's scientific activities left him with little leisure time. He was a devoted listener of recorded music and collected classical records. He regretted that he had neither learned to play a musical instrument nor read music. An enthusiastic amateur painter in oils, he preferred copying old masters rather than painting original pictures. He read widely in general literature, biographies, history of modern times, and the history of science. He had a fine collection of old books on the history of biology and medicine, most of which he later donated to libraries.

Like so many of his friends, I am immeasurably richer for having known "perhaps the last great general histologist" (W. L. Doyle in *The Anatomical Record* 177:108-9, 1973) in the tradition of Giuseppe Levi and Weidenreich.

I AM INDEBTED TO Margaret Bloom, Don W. Fawcett, and William L. Doyle for numerous documents and verbal information from which I have extracted liberally. I had useful discussions with Humberto Fernandez-Moran, who is particularly grateful to William Bloom for bringing him to Chicago.

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