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MAXWELL MAYER WINTROBE

1901—1986

A Biographical Memoir by

WILLIAM N. VALENTINE

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October 27, 1901–December 9, 1986

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WHEN MAXWELL MYER WINTROBE died in Salt Lake City on December 9, 1986, his distinguished career in medicine and in his subspecialty of hematology had spanned some sixty years—from the conquest of pernicious anemia to the present. His scientific achievements are recorded in more than 400 publications. His *Clinical Hematology*, first published in 1942 and currently in its eighth edition, remains a prototype of excellence and for many years stood alone as the premier text in his chosen field.

In 1943 Max Wintrobe became the founding chairman of the Department of Medicine at the University of Utah—a post he filled with great energy and ability until 1967. From that time until his death he continued an active and productive career at Utah as Distinguished Professor.

By all accounts, Max was a world leader in hematology, a role attested to by a legion of honors, visiting professorships, memberships, and activities in national and international scientific societies, consultantships, editorial responsibilities, and—perhaps most importantly—by the large cadre of students who had flocked to be under his tutelage and who themselves went on to be leaders in their medical communities and in academia.

EDUCATION AND EARLY LIFE

Max Wintrobe was born October 27, 1901, in Halifax, Nova Scotia. His parents (both of whom had emigrated from Austria) adjusted rapidly to the new community, adding the English language to their repertoire of German, Polish, and Yiddish. Their educational background was limited and their lifestyle frugal, as dictated by modest means. His mother's family, the Zwerlings, was large and had been in Canada for many years. Max, an only child, responded to his mother's deep interest in education and her urgings to study, work hard, and achieve. In 1912, the family moved to Winnipeg, Manitoba, where, however, there were few friends and no family.

A better-than-average student, Max entered the University of Manitoba at age fifteen. Having already determined on a medical career, he also made the decision to spend four undergraduate years before entering medical school, though only one year was required at the time. At the University he showed his facility for language, favoring English, Latin, and French and winning gold medals in the latter and in political economy. He also discovered his love of history and the well-turned phrase—so important to his later career.

Entering medical school at twenty, Max developed a special interest in the Johns Hopkins Medical Center through the writings of William Osler, but limited circumstances prevented any thought of transferring. Throughout his undergraduate and medical school years he worked at a variety of odd jobs to further his education and to help the family finances. Of his teachers at Manitoba he remembered William Boyd, professor of pathology—a flowery and exciting lecturer with a rich Scottish brogue—as the most stimulating.

But as graduation neared, Max, who had achieved an outstanding record, became increasingly aware of his lack of

desire to go into private practice, though other opportunities were few and resources limited. After his internship and receipt of the M.D. degree in 1926, the dilemma was resolved by the offer of the first Gordon Bell Fellowship, named in honor of the dean of the University who had just retired.

Wintrobe was first assigned the task of determining the relative prevalence of achlorhydria in certain western Canadian communities where the incidence of pernicious anemia—a subject of especially great interest in 1926—was believed to vary widely. A second assignment, pursued energetically but fruitlessly, was to produce achylia gastrica in dogs. Thus was launched a distinguished, lifelong academic career in the field of hematology.

THE TULANE YEARS (1927–1930): "ANEMIA OF THE SOUTH," NORMAL BLOOD VALUES, THE WINTROBE HEMATOCRIT, AND CORPUSCULAR CONSTANTS

In September 1927, Max arrived in New Orleans, having accepted the offer of an appointment as assistant in medicine at Tulane University from Dean C. Bass. Assured of an annual stipend of $1,800 and a small laboratory next to Roy Turner—a Hopkins graduate and the consummate erudite clinician—it was possible to get married. Max returned to Winnipeg and shortly thereafter, on January 1, 1928, brought his bride, née Becky Zamphir, from the –50°F of Winnipeg to bright, sunny New Orleans.

Max's New Orleans years were both pleasant and productive. Charity Hospital offered a wealth of clinical material, including nutritional and other anemias of all types, tropical disease, tuberculosis, and every variety of neoplasia. John H. Musser, the distinguished chief of medicine, suggested that Wintrobe find out if the widely believed "anemia of the South" myth actually existed. Though Max could not identify any such entity, the study allowed him to collect data and

develop techniques that became an integral part of the clinical evaluation of all patients, not only those with blood and marrow disorders.

He first worked to document statistically normal values for hematologic parameters in normal adults and children. Accepted round numbers of normality at that time were derived from only a few counts and from observations some seventy-five years old. A "normal" hemoglobin value in men was expressed as 100%. Wintrobe's careful observations made on Tulane medical students and women from Sophie Newcomb College—together with observations by Russell Haden in Cleveland, Edwin Osgood in Portland, and a few made in Europe—served as basic data for establishing normality in terms of quantitatively accurate observations.

Max's second important contribution was the invention of the Wintrobe hematocrit, which universally replaced the leaky, awkwardly calibrated and poorly conceived devices of the 1920s. Wintrobe's calibrated, straight-sided tube held about a milliliter of blood. Most importantly, any venous blood sample being measured in the tube was anticoagulated with a combination of potassium and ammonium oxalate that did not cause cells to shrink or swell. Although many millions of the Wintrobe hematocrits have been sold, neither Wintrobe nor Tulane profited. Since the instrument was intended for the public good, Wintrobe refused all royalties and applied for no patent.

Another important innovation came to Wintrobe in the middle of the night while puzzling over the inadequacies of the various indices then in vogue. These included color, volume, and saturation indices derived indirectly from ratios based on "percent of normal" for red cell numbers, hemoglobin content, etc. Wintrobe's method permitted direct calculation of the average cell size, MCV (mean corpuscular volume in cubic microns), MCH (mean hemoglobin content in

picograms), and MCHC (mean corpuscular hemoglobin concentration in percent)—quantifications that are standard procedure in research and clinical laboratories today.

J. H. Musser's invitation to assist him in rewriting the section on diseases of the blood for the ten-volume looseleaf set of the *Tice Practice of Medicine* (1931,3) marked a new step in Wintrobe's career. The new section was documented with great care and had a lengthy bibliography, not a common practice at the time. This desire for full bibliographical documentation later resulted in one of the most valuable features of Wintrobe's textbook *Clinical Hematology* (1942,5).

During his three years in New Orleans, Wintrobe worked toward his Ph.D. degree. His thesis, *The Erythrocyte in Man* (1930,3), represented a review of world literature and of his own studies in that field.

In his efforts to apply appropriate statistical methods to his own data, Wintrobe had contacted Raymond Pearl at Johns Hopkins, author of the helpful *Introduction to Medical Biometry and Statistics*. With the assistance of Dean Bass, Wintrobe was able to journey to Hopkins, see Pearl, and meet Alan Chesney, dean of the Medical School. When searching for a suitable publication for his thesis sometime later, Wintrobe hit upon the review journal *Medicine*; serendipitously, Chesney was its editor. Chance again favored Max, his thesis was published, and his long-cherished wish to study and work at Hopkins became a reality. He was offered an appointment as instructor in the Division of Clinical Microscopy.

JOHNS HOPKINS (1930–1943)

The Wintrobes found some aspects of life in Baltimore less than pleasing, but medically and scientifically Hopkins was all they had hoped for. Max directed the second- and third-year courses in clinical microscopy, stimulating his students by integrating laboratory findings with clinical prob-

lems and diagnoses. In addition he worked in the Outpatient Department and gave consultations as requested—a practice that burgeoned as his reputation spread.

The student caliber was good, the faculty talented and in the forefront of medicine. The times were busy but the Great Depression had brought austerity to all. Max had no secretarial assistance and there were no funds to train technicians. He trained his own assistants (including Becky) but could pay them nothing. Instead, he bartered training for their services. To assist in studies in comparative hematology, Becky first mastered the art of venipuncture on fish, and she subsequently became chief technician at the diagnostic clinic.

Max carried out studies of comparative hematology on animals in the Washington, D.C., Zoo, and—during one enjoyable summer—at Mountain Desert Island in Maine, where Homer Smith, Jim Shannon, and other distinguished scientists were also working. The Wintrobes spent other summers pleasantly working at Woods Hole in Massachusetts.

Baltimore was the site of much intellectual exchange in medicine, and Wintrobe enjoyed and benefited from discussions with his many colleagues, including George Minot, Bill Castle, and others of the Boston group. Max's career-long interest in pernicious anemia, for instance, was furthered by his admiration of Castle's classic experiments, and Castle appropriately authored the foreword to his last book, *Hematology, the Blossoming of a Science* (1985,1).

It was also fitting that Irving Sherman, a Hopkins student working with Wintrobe, incidentally noted birefringence of sickled red cells in the course of his studies on the role of deoxygenation in producing sickling. Bill Castle later brought this finding to the attention of Linus Pauling in a chance conversation, giving birth to studies that would define the molecular lesion of hemoglobin responsible for sickle cell anemia and usher in the era of molecular biology.

In 1933 Becky and Max, backed by a six-month leave and a half-year's pay, embarked on the first of their many trips to Europe. During these months they visited a large number of institutions and met many of the current and future leaders of hematology in England and on the continent. Among many others were Otto Naegli of Zurich, acknowledged as the outstanding hematologist in Europe, Isidore Snapper, whose clinic was in Holland, Paul Morawitz of Leipzig, and Janet Vaughn of England. Although Max's first paper was published in 1928 in the *New Orleans Medical and Surgical Journal*, by 1933 he had already achieved a considerable reputation in the field of hematology.

At Hopkins he sought to expand his data on normal blood values and on the uses of the hematocrit. He demonstrated that the hematocrit effectively measured erythrocyte sedimentation rate and that, when proper centrifugation was employed, the volume of packed red cells could be ascertained accurately and the mass of leukocytes and platelets roughly approximated. The supernatant plasma was also a convenient medium for determining icterus. With the hematocrit, Wintrobe was also able to demonstrate a cryoglobulin in blood and to diagnose a previously unsuspected case of multiple myeloma. As he and Buell reported in the *Bulletin of the Johns Hopkins Hospital* (1933,2), the temperature dependent, reversible turbidity evident in supernatant plasma in a hematocrit temporarily placed in a refrigerator, had led the researchers to this diagnosis.

After returning from Europe, Max resumed a busy schedule of writing and research. In 1940 he published a study of forty members of three Italian families, some of whom suffered from splenomegaly, mild icterus, and blood changes recognized as a mild form of thalassemia. In a footnote he pointed out that the same condition had been observed in the parents of a patient with Cooley's anemia, also cited in a

later table in his first edition of *Clinical Hematology*. This observation coincided with independent observations by Dameshek and Strauss in America and Silvestroni and Bianco, somewhat later, in Italy, to establish the recessive transmission of thalassemia. In 1938, another study by Wintrobe and Robert H. Williams (later to head the Department of Medicine at the University of Washington in Seattle) demonstrated that nonautolyzed yeast in sufficient amounts could induce a hemopoietic response in patients with pernicious anemia. As a house officer, Williams was able to sequester suitable subjects from the eye of Professor Longcope, who was unenthusiastic about the study. The hemopoietic response presumably arose from large amounts of folic acid in the yeast supplement.

Other studies conducted with H. B. Schumacker, who later became chief of surgery at Indiana University, centered on the significance of macrocytosis and its association with liver disease. Struck by the fact that macrocytosis occurred in both human and animal fetal development, Max, his students, and coworkers began studying fetal blood in experimental animals. The opossum proved unaccommodating and was abandoned, but the domestic pig proved more tractable. Wintrobe's early work with this animal model provided a basis for his later studies in nutritional anemia, vitamin deficiency, and trace metal metabolism carried out at Utah. Though attempts to produce pernicious anemia in animals proved fruitless, other studies brought about diverse scientific contributions in many areas: the role of splenectomy in thrombocytopenic purpura, the etiology and management of the anemias, and the diverse manifestations of the leukemias. Quantitatively determined corpuscular constants became universally accepted as a basis for classifying red cell disorders.

All of these investigations, both clinical and in the laboratory, followed Max's modus operandi. Experiments were

done meticulously, records were fully documented and maintained, all available literature was explored thoroughly, and compendious bibliographies were compiled. Max consistently involved both students and house officers in his research activities, and his association with fine investigators (such as pathologist Arnold Rich) stimulated the flow of ideas while building valuable contacts. Many of these students and house officers later achieved fame, including George Eastman Cartwright, who worked with Max as a second-year student, followed him to Salt Lake City, and in 1967 succeeded him as Utah's chairman of medicine.

On Pearl Harbor Day, December 7, 1941, Max was working to complete the index of the first edition of *Clinical Hematology* (1942,5). Since the authorities insisted he remain in Baltimore he began studying chemical warfare agents with Professor Longcope and Val Jaeger, then a house officer. At Utah, he and Jaeger later continued the work begun at Baltimore's U.S. Army Edgewood Arsenal (in Baltimore). In 1943, Max was called to be the chairman of Medicine at the newly established University of Utah Medical School—the first four-year medical school between Denver and the Pacific Coast from Canada to Mexico.

THE UTAH YEARS (1943–1986)

Max was now an established leader in hematology in charge of the Clinic for Nutritional, Gastrointestinal and Hemopoietic Disorders and an associate physician at Hopkins. *Clinical Hematology*, published in 1942, had filled a major void in the field and was well on its way to becoming the leading hematological reference work.

But when the Wintrobes and their young daughter, Susan Hope (born in Baltimore in 1937), considered moving to Utah in 1943, they did so with considerable trepidation. As Canadians, they knew little about Utah, but two Hopkins

men—Phillip Price and A. Louis Dippel—were going there as, respectively, chief of Surgery and chief of Obstetrics-Gynecology at the new school. In addition, Alan Gregg, vice-president of the Rockefeller Foundation, and Isaiah Bowman, president of Johns Hopkins, both urged Max to accept, stressing the importance of this opportunity to open a new frontier.

But if Utah offered "opportunity," it offered, in Max's own word, "absolutely nothing more." The hospital's clinical facilities and plant were run down and poorly administered. The medical school was housed in a dormitory constructed for World War I cavalry officers. The promised new medical center materialized only after twenty-two years, to be dedicated two years before Max's retirement as chief of medicine. In 1943, as far as he was concerned, faculty in all departments had to be recruited, medical care improved, student scholastic standards raised, goals reoriented, research projects and facilities established, and supporting funds obtained.

Despite these hard facts, all the departments continued to grow steadily, and their chairmen functioned well together. By 1950, the Department of Medicine faculty numbered ten and included high-caliber, enthusiastic recruits dedicated to the goal of establishing a first-rate medical school. The Hematology Division enjoyed worldwide fame, attracting young physicians from North America and elsewhere in large numbers.

Max instituted a program (later widely emulated) whereby students, house officers, and fellows initially examined all patients, whether private or nonpaying, as subjects for undergraduate and graduate teaching. Between 1947 and 1984, 170 graduate students were trained in hematology and participated in research activities at Utah. Well over half remained in academic medicine, a number as leaders, and

several later shared authorship with Max in the seventh and eighth editions of *Clinical Hematology.*

The National Institutes of Health first research grant went to the Utah study of muscular dystrophy and other hereditary and metabolic disorders. Encouraged to seek federal support by Senator Elbert Thomas of Utah, chairman of the Senate Committee on Health, Max had applied. Senator Thomas and U.S. Surgeon General Parran wanted to continue peacetime support of medical research, and the Utah senator was also an enthusiastic supporter of his state's new four-year school. The initial bill provided $100,000 a year, which was subsequently renewed for twenty-three years, providing the new school monies for faculty recruitment in many fields other than medicine.

The grant supported work that would bring recognition and renown to the school and its staff. Muscular dystrophy of a hereditary type affected a considerable number of Utah families, and the Mormon reservoir of genealogical data was a substantial aid to research. Max served as director of the Laboratory of Hereditary and Metabolic Disorders from 1945 to 1973 and was succeeded by Frank Tyler, who had, from its inception, been head of its Clinical Division. Among Utah's more distinguished recruits was Emil Smith, who began his important studies in biochemistry in shacks, all the research facilities then available.

During the years when Max served as Utah's founding chairman of medicine he also became an international leader in his chosen field, well beyond the University confines. He served as a visiting professor throughout the world and received honors and filled high positions too abundant to mention. His twenty-five years of participation in the work of the Research Grants Division of NIH began in 1949 and included four years on the Council of the Institute of Arthritis

and Metabolic Diseases, four years on the Allergy and Infectious Disease Council, and service on the Study Sections of Biochemistry and Hematology (including chairmanship of the latter) and on a variety of NIH committees with special charges.

His many other responsibilities included consultantships to the Army, the Atomic Energy Commission, and the World Health Organization; chairmanship of the Advisory Committee of the Leukemia Society; and nine years in various capacities with the American Medical Association's Council on Drugs.

From 1964 to 1974, Max served as member and chairman of the Scientific Advisory Committee, Scripps Clinic and Research Foundation, La Jolla. He was president of a large number of prestigious learned societies including the Western Association of Physicians, the Association of Professors of Medicine, the Association of American Physicians, and the American and International Societies of Hematology. He became a master of the American College of Physicians in 1973 and the same year received the Robert H. Williams Award of the Association of Professors of Medicine. In 1974, Cecil Watson presented him with the coveted Kober Medal of the Association of American Physicians. Elected to the National Academy of Sciences in 1973, he became the first chairman of the Section on Human Genetics, Hematology, and Oncology and, for three years, secretary of the Class on Medical Sciences.

The Utah Group and the Wintrobe Legacy

Despite this plethora of commitments, Max's hematology research program at Utah flourished and expanded. As his own involvement in national and international activities increased, G. E. Cartwright, then head of Hematology, assumed direction of the Research and Training Programs.

Yet if Max was less active in the laboratory, he continued to be involved with the University, particularly in the area of training. He also wrote more than two dozen papers on the pathogenesis of the anemia of infections—including studies of erythrocyte life span, marrow response, and the impaired return of iron from the macrophage to plasma.

Extending Wintrobe's original Baltimore experiments with pigs (recorded in some seventeen papers), the Utah group established the pig as a model experimental animal. They defined deficiencies of the vitamin B complex and neurologic lesions but were unable to produce pernicious anemia in the pig. They documented megaloblastic anemias responsive to folic acid and B_{12} when folic acid antagonists and a nonabsorbable sulfonamide were added to a base diet lacking folate and B_{12}. Cartwright et al. reported in detail the striking changes involving blood, marrow, the central nervous system, and the liver that responded fully and specifically to the addition of pyridoxine to a vitamin B_6-deficient diet.

Pigs also served as subjects for important studies of iron, copper, and porphyrin metabolism—studies later extended to man. Cartwright's investigations of hepatolenticular degeneration (Wilson's disease) and hereditary hemochromatosis were particularly noteworthy, while G. Richard Lee made important observations on the involvement of copper in iron metabolism, the role of the copper transport protein ceruloplasmin, and sideroblastic anemia.

The Utah group (particularly Jack Athens, G. E. Cartwright, A. M. Mauer, and Dane Boggs) also made highly significant investigations of leukocyte physiology and kinetics. Athens succeeded Cartwright as head of hematology in 1967. Boggs later transferred his studies of host defense mechanisms, leukocyte kinetics, and the hematopoietic stem cell to the University of Pittsburgh. There were many others in the Utah group—students, residents, fellows, and faculty—who

contributed to clinical and bench investigations of the leukemias, aplastic and sideroblastic anemias, the spleen, the hemoglobinopathies, coagulation disorders, and other aspects of the spectrum of hematologic disease.

At Utah, Jaeger and Wintrobe continued studies on chemical warfare agents they had begun in Baltimore during World War II. The effects of nitrogen mustard on hematopoiesis they observed led them to investigate its therapeutic usefulness in human neoplasia reported by Goodman et al. in 1946. Independently initiated therapeutic trials were reported about the same time by Jacobsen et al. in Chicago.

During the Utah years, the Wintrobes exploited Becky's talent as a hostess to initiate an annual garden party for newcomers, faculty, fellows, house staff, and town friends. The list of those attending this summer function eventually grew to more than 400 guests.

They also enjoyed departmental picnics and bonfires at dusk in the canyons. Within an hour's drive lay the beautiful Wasatch Mountains, the snows of Alta, and some of the world's finest skiing. It became a tradition that, on Wednesday afternoons, the Department of Medicine at Utah was to be found skiing in the mountains. Max, along with George Cartwright, grew to love this recreation, and Cecil Watson described the Wednesday afternoon jaunts as his "Maxiavellian" plan to promote morale and friendship within the Department and among the disciplines. Watson speculated that Max and George's love for, and skill at, skiing were aided by their physical constitutions and centers of gravity.

Max had studied the violin in high school and carried over a love for chamber music. Though absorption in his profession caused him to abandon music for many years, at Utah he again took up his violin, studying with the concertmaster of the Utah Symphony. He enjoyed playing chamber music with friends. On receiving the prestigious Ferrata Prize in

Rome, he used some of the associated monies to purchase an Enrico Politi violin. From 1963 to 1965 he served as a member of the Utah Symphony Board, becoming a member of its National Advisory Board after 1976.

But there was also tragedy and adversity in Utah. In 1952, while in a car driven by friends, a collision on a slippery road resulted in the deaths of the Wintrobe's son Paul, born in 1944, and of their friends' child. Max, Becky, and their daughter were also injured in the accident.

CLINICAL HEMATOLOGY; PRINCIPLES OF INTERNAL MEDICINE; BLOOD, PURE AND ELOQUENT

It would be difficult to overestimate the impact of *Clinical Hematology* on students, house officers, and hematologists since its initial publication in 1942. Authoritatively written, compendious, heavily and meticulously referenced and indexed, there is no doubt that it was the premier textbook in hematology of its time. Nor can we appreciate how narrow was the scope and restricted the outlook of the field even as recently as the 1920s. The tenth edition of Osler's *Principles and Practice of Medicine*, published about the middle of that decade, devotes appreciably less space (thirty pages) to all the disorders of blood combined than to the discussion of typhoid fever (forty-two pages).

The eighth and most recent edition of *Clinical Hematology* (1981) ran to more than 2,000 pages. Max had written and edited the first six editions by himself, though always depending on the unreserved, critical peer review and proofreading of his talented colleagues at Utah, with Becky, as he said, his severest and most helpful critic. The seventh and eighth editions were coauthored with several former fellows and associates. The eighth edition appeared in 1981, and Max was at work on the ninth at the time of his death in 1986. While recent years have seen other equally authorita-

tive and compendious hematology texts, *Clinical Hematology* was the prototype and remains a model of excellence in the field.

A second publishing endeavor highly valued by Max was the *Principles of Internal Medicine* (1950,1; 1954,3; 1974,1), with Tinsley R. Harrison as editor-in-chief. In 1950 when *Principles* was first published, Cecil and Loeb's excellent text enjoyed a near monopoly in its field. Harrison's *Principles*, with its emphasis on the pathophysiology and biochemistry of disease, opened the way for a new approach. *Principles* recommended diagnosis and treatment based not only on the signs and symptoms that brought the patient to the physician, but also on this pathophysiology.

The original authors included Harrison, Resnick, Dock, Keefer, and Wintrobe, who were later joined by Paul Beeson, George Thorn, and others. Max was coeditor of this highly successful text through five editions, and the book was translated into Portuguese, Italian, Polish, and Greek. For the sixth and seventh editions, he served as editor-in-chief.

Max's final literary efforts sprang from a long-standing interest in medical history. *Blood, Pure and Eloquent* (1980,1), edited and partly authored by Max, was (like *Clinical Hematology)* dedicated "To Becky." It includes his own chapters on classic early discoveries in hematology, followed by chapters written by contemporary hematologists who themselves had made significant contributions to the subject areas of which they wrote.

Most recently, his *Hematology, the Blossoming of a Science: A Story of Inspiration and Effort* (1985,1) tells the human history of many contributors to the field through more than 500 biographical sketches. Writing this book as part memoir, part history, Wintrobe yet realized that he could never cover the lives of all who had contributed to "the Golden Age of hematology."

RETIREMENT FROM THE CHAIR OF MEDICINE

In 1967 Max was succeeded at Utah as head of the Department of Medicine and physician-in-chief at the University Hospital by George Cartwright; it can hardly be said he retired. As Distinguished Professor of Internal Medicine he continued to see patients and, of course, write. He continued old activities, initiated new ones, and received a cascade of honors and awards after becoming emeritus. His *curriculum vitae* shows more than twenty visiting professorships at major universities in the United States and abroad after 1967.

In 1977 the Wintrobes purchased a condominium in Palm Desert and thereafter spent the winter months in the more gentle climate of southern California. This meant an end to skiing but the opportunity to golf, write, edit, and relax.

Many agencies—private and governmental—continued their demand for Max's participation. As a senior statesman and ambassador his style underwent little change. He spoke in deep, carefully measured tones, and when he was in charge, he ran a tight ship. He never dispensed the fruits of experience and wisdom with the benignity of a Bernard Baruch, from a park bench. Fair and decisive, he held strong opinions, and he did not hesitate to express them and would scrap for a cause he believed in.

Reminiscing in 1984, he stated that he was unequivocally happy to have accepted the challenge and come to Utah in 1943. As he looked back over the forty years since leaving Hopkins, a time that had been full of opportunities and crowned with achievement, he and Becky could only conclude they were glad they had ventured.

When Max received his M.D. in 1926, the death sentence of a diagnosis of pernicious anemia had just been commuted and the discipline of hematology (essentially based on morphology) would never be the same. That same year Cooley

was to identify the anemia that bears his name, but the thalassemia syndromes—their genetics, expression in heterozygotes, and molecular basis—remained unknown.

The first hospital-operated blood bank would not appear for more than another decade. The Rh-antigen system was undiscovered. The Coombs' test and autoimmune disease were unknown and the erythroenzymopathies unsuspected. The genetic code, the hemoglobinopathies and their molecular basis were not the subject of any text. Nobody knew of erythropoietin or discussed "B" and "T" lymphocytes, "colony stimulating factor," lymphokines, or granulocyte metabolism and kinetics. There were no chemotherapeutic agents for malignant blood dyscrasias except the arsenical Fowler's solution employed in treating chronic granulocytic leukemia. No one had thought of marrow transplants, genetic engineering, or the role of oncogenes.

These fragments of the explosion of information uncovered between 1926 and Max's death in 1986 give some small idea of what he liked to call the Golden Age of Hematology. It was indeed a golden era—and Max Wintrobe was one of its chief architects and ambassadors to the world.

Max is survived by his wife, Becky; his daughter, Susan; and his four grandsons, Andrew, Stephen, Timothy, and David Brown.

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