NATIONAL ACADEMY OF SCIENCES

# KARL TAYLOR COMPTON

*1887—1954*

*A Biographical Memoir by*

JULIUS A. STRATTON



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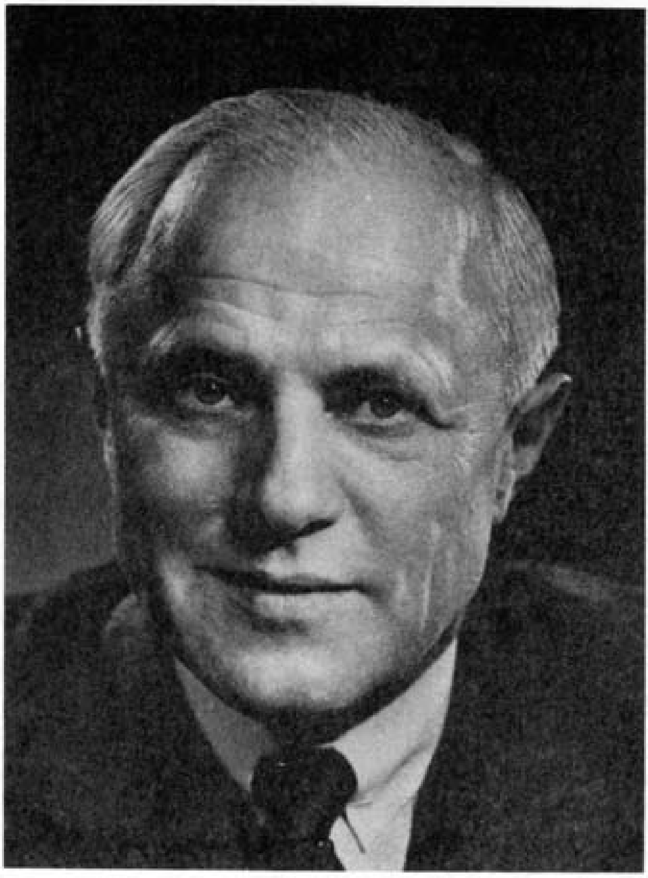



Karl T. Compton

# KARL TAYLOR COMPTON

*September 14, 1887–June 22, 1954*

BY JULIUS A. STRATTON

TO DO FULL JUSTICE to Karl Compton is an impossible task, for the range of his interests and activities was virtually limitless, his effect upon the scientific community profound, and his service to our country in time of war—and in quieter days—far greater than a nation could expect from a single individual. He was a leader whose fine mind matched his radiant personality and understanding heart. He was a man of principle whose transparently honest goals moved men, a warm friend who inspired loyalty, and a mentor who engendered pride in achievement. Those of us who knew him closely felt the shining example of his own life, and the intervening years make us ever more conscious of the greatest of his legacies to us—his focused and unquenchable spirit.

## THE EARLY YEARS (1887–1918)

Karl Taylor Compton was born in Wooster, Ohio, on September 14, 1887, the eldest child of Elias and Otelia Augspurger Compton. Mary, Wilson, and Arthur would follow. Elias's Anglo-Saxon Presbyterian forebears had come to America prior to the Revolution and eventually settled in Ohio, to which Otelia's family—Alsatian and Hessian Mennonites—came early in the nineteenth century.

Elias, who grew up on a farm, taught school before entering the University (now College) of Wooster, a Presbyterian institution, from which he was graduated with highest academic honors in 1881. He moved on to theological school, full of plans for the ministry and service in foreign missions. In his final year, however, he responded to a call from Wooster to substitute for an ailing professor. Ordination, on the basis of these nearly completed studies, was granted in 1897. He had performed so well at Wooster that he was urged to accept a regular appointment, and he remained there until his retirement, becoming professor of philosophy and serving for many years as Dean.

Elias Compton married Otelia Augspurger in 1886, and the pair proved to be remarkable parents of a remarkable family. The three sons, all with Princeton doctorates, eventually became college presidents. Two—Karl and Arthur—were distinguished physicists, and the latter became a Nobel Prize laureate in 1927. Their daughter, Mary, an excellent scholar and honor graduate of Wooster, fulfilled a parental dream by spending many years in India as the wife of C. Herbert Rice (also a college president) and as an active missionary worker.

The four young Comptons' lives and achievements are perfect testimony to the importance of childhood environment and the influence of home and family. There can be no doubt that the strength of Karl Compton's character and his supreme regard for the individual, as well as his innate ability and intelligence, stem from his background. It was a family reared in an atmosphere of stability and spirituality, of discipline and understanding, of shared interests and responsibilities and commitment to the common good. There was, in addition, always time for fun and the enjoyment of life.

A rough outline of "preliminary random ideas, to be refined" indicates that K.T., as he came to be known by many, intended to write his memoirs—which, had he been spared, surely would have presented a fascinating, honest account of a productive and eventful life. First on his list were his parents, their plans, and their home on College Avenue—always a haven for students and the central focus of his early days; then came his friends, the gangs, and the games; his public school days and skipping a grade; transfer in 1902 to Wooster's preparatory department for the last two years of high school, and his college days there. He would have emphasized the jobs he took from the age of eleven through college to earn spending money and also, as he once said, "to harden my muscles for athletics." He carried hods on construction projects, worked as a farm hand, mule skinner, and book canvasser, in tile and brick factories, and, following a brief introduction to surveying in a mathematics course, on the "first mile of state-paved road in Ohio." He enjoyed "the daily grind of the pick and shovel gang" and "the finesse to be acquired in pitching a shovelful of dirt onto a wagon." From the men he came to know who dug ditches, laid bricks, worked on farms, and whose "good qualities and special abilities" he appreciated, he learned "the joy of working with your hands."

Beginning in 1897, Karl's summer vacations were spent camping out at Lake Otsego in Michigan with friends and students from the college joining the family party. There he developed a lasting appreciation for the outdoor life, fishing, canoeing, hiking, hunting. For relaxation he liked nothing better than a strenuous canoe trip in the wilderness. It was an interest that provided more than an opportunity for quiet reflection and the testing of physical endurance. It also provided the challenge of leaving the camp site better than he had found it, and he brought to that task the same sense of responsibility that would guide him in every effort he undertook.

Both Karl and Arthur gave early evidence of an interest in science. Though Karl announced while still in the preparatory department that he wanted to be a scientist, he still had not decided on a specific field when he was a sophomore in college. At that time he was doing odd jobs in the biology laboratory, and looked forward to an assistantship for the following year. Funds did not become available, however, and he accepted an appointment in the Physics Department as an assistant in charge of arranging equipment and setting up laboratory experiments. But for this change in circumstances, he might well have become a biologist rather than a physicist. He would often cite this incident as an example of how seemingly minor events can alter the direction of one's life.

Karl was graduated cum laude in 1908 with a bachelor of philosophy degree. As an undergraduate he had been in every way an outstanding student leader and participant in extracurricular activities. He was, above all, a fine athlete. He was a left end on the football team and became captain in his senior year. As a member of the varsity baseball team (of which he also served as captain), he was a good hitter and fielder and, as a senior, served as pitcher. He also coached the girls' basketball team, was active in his fraternity, and taught a Bible class for the Y.M.C.A.

He remained at Wooster as a graduate assistant and laboratory demonstrator for elementary physics. It was a period in which he demonstrated a remarkable aptitude for teaching and—in the assessment of a later colleague—experienced an awakening of "genuine scientific understanding." His master of science degree was awarded in 1909, and his thesis, "A Study of the Wehnelt Electrolytic Interrupter," was published in the *Physical Review* the following year, the first of hundreds of publications.

The year 1909 brought an important decision with respect to his future. Karl received an offer to head the science department of a missionary college in Korea—exactly the kind of life work Elias hoped his eldest son would choose to follow. But misgivings about his readiness for such a responsibility were reinforced by his father, who counseled that the best preparation for a teaching career would be further graduate work at a great university with superb library and laboratory facilities. Karl decided upon Princeton, attracted by its new Palmer Physical Laboratory and the presence of two physicists from Cambridge University: Owen W. Richardson and James H. Jeans. Still, he was forced to postpone his enrollment there until he could amass sufficient funds.

An appointment as instructor of chemistry at Wooster for 1909–10 was welcome—not only for the money it would provide, but also for the opportunity to continue to play baseball with a local "bush league" team. During that year, however, Karl rapidly increased his reputation as an outstanding teacher, a reputation he would maintain for many years to come.

Entering Princeton in 1910, Karl Compton was appointed to a half-time teaching assistantship and in 1911 was awarded the Porter Ogden Jacobus Fellowship, the most prized fellowship at the university, which recognizes the highest scholastic achievement in the graduate school. Because of O. W. Richardson's interest in experimental and laboratory work, Compton chose to work with him to complete his doctorate and through him was led to a deepening interest in electron theory. His thesis dealt with electrons liberated by ultraviolet light. It was followed by several papers—authored jointly with Richardson—on the photoelastic effect, as well as several experiments testing a theory that would later bring Richardson the Nobel Prize. Compton received his Ph.D., summa cum laude, in 1912, and he had already accepted an appointment to teach physics beginning in 1913 at Reed College, a new undergraduate institution in Portland, Oregon. A one-year postdoctoral appointment at Princeton allowed him to remain there to carry on the research undertaken with Richardson, which led to further publications on the photoelastic effect. During that year Karl's brother Wilson came to Princeton to take a doctorate in economics.

In June 1913, Karl Compton married Rowena Rayman, whom he had met at Wooster during his freshman year and to whom he had been engaged since 1908. They took up residence on the Reed campus, and so began his active professional life.

At Reed, Compton's title was instructor, yet he was solely responsible for the instruction in physics and worked hard to build up the department and its laboratory facilities. He inspired his students with an interest in research, collected apparatus, carried on experiments, and published a number of papers in the *Physical Review.* He looked upon these years as wonderful experience but was happy to return to Princeton in 1915 as assistant professor of physics.

## PRINCETON YEARS (1915–30)

Karl's brother Wilson had received his Ph.D. from Princeton in June 1915 and was teaching at Dartmouth, but Arthur, who had begun work for a master's in physics in the fall of 1913, was still there, a year away from completing his doctorate. They enjoyed working together on research and, during this period, developed a device known as the Compton Electrometer. At this time also, Karl declined an offer to join the General Electric Company as a research physicist, while agreeing to act as a consultant under an arrangement that continued for many years.

Anxious to do his part in World War I, Karl began working on projects at Princeton, the Thomas A. Edison Laboratories, and the Signal Corps in Washington, D.C. Associated with the Research Information Service in December 1917, he was sent to Paris and assigned to the American Embassy as an associate scientific attaché. Beyond the technical work involved, this experience afforded an opportunity to come in contact with many important scientists and engineers with whom he developed life-long relationships. Above all, he came to understand the urgent need in time of war for what he later called "combat scientists"—though he could hardly have foreseen the major role he would play in World War II.

Following the Armistice of November 1918, Karl Compton returned home to his wife and three-year-old daughter, Mary Evelyn, and to Princeton, to which he had become deeply attached. Sadly, Rowena died in the fall of 1919.

In June of that year, at the age of thirty-one, Compton's outstanding qualities as a teacher and experimental physicist were rewarded by promotion to full professor. His gift for teaching was to become almost legendary at Princeton, a gift marked not alone by the clarity of his presentation and a contagious enthusiasm, but also by his manifest concern for the well-being and progress of each student. Yet this dedication to teaching in no way detracted from his interest and devotion to research. He was soon recognized as the most distinguished member of the Palmer Laboratory, and graduate students came in increasing numbers to work under his direction.

Broadly, his field included electronics and spectroscopy, his research ranging over such subjects as the passage of photoelectrons through metals, ionization and the motion of electrons in gases, the phenomena of fluorescence, the theory of the electric arc, absorption and emission spectra in mercury vapor, and collisions of electrons and atoms. Over a hundred papers appeared in various scientific journals throughout the Princeton years, constituting an impressive testimonial to his vital energy and imagination and his generosity in sharing both work and credit with students and colleagues.

His reputation grew both nationally and internationally, and in 1927 he was named director of research at the Palmer Laboratory and appointed to the Cyrus Fogg Brackett Professorship. This new chair enabled him to concentrate on graduate work in the department, of which he was named chairman in 1929. He looked forward to years of teaching and research, determined to make Princeton's physics department the best in the world.

Then an invitation came that would profoundly alter the course of his life. Early in 1930, to his utter surprise—the greatest surprise, he once said, of his life—he was asked to become president of the Massachusetts Institute of Technology.

## MASSACHUSETTS INSTITUTE OF TECHNOLOGY (1930–54)

Compton was well acquainted with MIT's reputation as a distinguished school of engineering—an institution whose graduates had made enormous contributions to the progress of American industry and technology for nearly three-quarters of a century. But, with a few exceptions, MIT had (to use Compton's words) cut relatively little figure in scientific circles.

But enormous advances in science were rapidly transforming existing engineering practice and introducing a whole new range of future opportunities. An engineering education that focused largely on the techniques and procedures of current industrial practice was no longer adequate. Science lay at the heart of modern engineering, and MIT's scientific curriculum needed strengthening to prepare the school's students for the broadening horizons looming ahead. In those days the Institute was experiencing a period of intellectual unrest—an old-fashioned confrontation between conservative forces rooted in the past and young rebels bent on change. I was one of those young rebels in the Department of Physics, and we were fortunate to have the support of many senior faculty members who shared our views and reinforced our beliefs.

What we were witnessing, in fact, was the end of an era. We were awakening to a whole new world of science—science in its fundamental sense, which was almost totally missing from the Institute of that time—and to a new awareness of how this modern science might transform engineering of the future.There were signs that things were beginning to stir. New facilities for chemistry were already in the planning stage, distinguished physicists from abroad had been invited to spend short periods in Cambridge, and younger members of the faculty were returning from graduate work in Europe. But progress was frustratingly slow.

To the members of the MIT Corporation, Karl Compton was the perfect choice to lead the Institute to a bright future. Never having thought of assuming the presidency of any institution, he was loath to leave Princeton, his students, and his research. In the end, however, he was inspired by the challenge, as he explained in a letter to the editor of *The Daily Princetonian*: "the magnitude of this opportunity to help science 'make good' in engineering education creates an obligation which transcends other considerations."

He took office in July 1930 in a time of great need and—unhappily—adversity, for his arrival coincided not only with the onset of the Depression with all its financial nightmares, but also with a period when science and the applications of science were under attack, viewed by many as the cause of social ills and national despair. Compton would prove to be a courageous spokesman in defense of science and technology, and despite terrible problems of day-by-day funding, his contributions to the strengthening of basic science, to the quality of an Institute education, and to the enhancement of its international reputation will never be forgotten.

The Institute, of course, did not change character overnight. But everywhere, after Compton's arrival, there was a change of spirit, and it was clear that a new road lay ahead. By the end of his first five years in office, he had given MIT both an administrative and an educational structure, established clear lines of communication between faculty and administration, encouraged research and graduate study, supported curricular revisions, and established a graduate school. Compton was deeply conscious that the basic sciences and the spirit and methods of scientific research must find representation in the education of those who would contribute most heavily to the technological advances of the future. He also understood that if MIT's scientific departments were to make meaningful contributions, science for its own sake must have a legitimate place in the curriculum.

In 1921 Karl Compton had married again, and he and the former Margaret Hutchinson, a graduate of the University of Minnesota, won the hearts of students, faculty, and alumni through their friendliness, good will, and genuine concern for others. During his years as president, student amenities on campus were greatly improved, and (as one might have imagined) the athletic program received his wholehearted support.

Everything he set out to do as president he measured against the charter of the institution under his care. He responded with an enthusiastic "Yes!" in reaffirming the principles of that charter, and "its truly great idea of public service." His views on MIT's obligation for public service not only led to the Institute's extensive involvement in the government's scientific effort during World War II, but also helped create a model of cooperation between university and government that was emulated all over the country.

Under Compton's hand MIT underwent a revolutionary transformation, both of its intellectual temper and in the definition of its academic horizons. In this process he developed guidelines for a new approach to education in science and engineering, so that his influence extended far beyond the confines of a single institution.

Compton's active role in the Society for the Promotion of Engineering Education (now the American Society for Engineering Education), of which he was president in 1938, was, therefore, of special significance. As chairman of the Committee on Engineering Schools of the Engineers' Council for Professional Development he led the way in setting standards for the accreditation of engineering curricula. He believed that education, and particularly scientific and technical education, should be broadly based and responsive to the needs of the times, and that science should be put to work and could contribute significantly to industrial progress.

Despite his seemingly total immersion in teaching and research, Karl Compton—from the very outset of his career—took an active and constructive part in many of the affairs of the larger scientific community. In 1923 he was elected a member of the American Philosophical Society. The following year he became a member of the National Academy of Sciences, for which he served as chairman of the Section of Physics from 1927 to 1930. In 1925 the American Physical Society named him vice president, and two years later he succeeded to the presidency.

In the early 1930s, Compton joined with other leaders of the APS to organize the American Institute of Physics—a major achievement. Karl Compton guided this body—designed to bring together in federation a number of disparate societies relating to developing fields in physics, to serve as a spokesman for physics in relation to the general public, and to sponsor a program of publication for the dissemination of a burgeoning body of research results in the field—first as chairman of the board, from its inception in 1931 to 1936, and in succeeding years as a wise counselor. To this task he brought his characteristic energy, tact, vision, and wisdom. In his honor the Institute established, in 1957, the Karl Taylor Compton Medal Award "for distinguished service in the advancement of physics."

In 1935, Compton also served as president of the American Association for the Advancement of Science. He was a fellow of the Optical Society of America and a member of the American Chemical Society, the Franklin Institute, and several professional engineering societies.

## WORLD WAR II: COOPERATION WITH THE MILITARY

In 1933 President Roosevelt asked Karl Compton to chair a new Scientific Advisory Board. Its creation was not accompanied by a clear mandate from the government, however, and it was discontinued two years later. But with the advent of World War II, he once more moved to the forefront of scientists who saw the need for reliable scientific advice at the highest level of government. When the National Defense Research Committee was created in 1940, under the chairmanship of Vannevar Bush, Compton was appointed a member and chief of Division D, which comprised those academic and industrial engineers and scientists responsible for detection—chiefly radar, fire control, instruments, and heat radiation. In 1941, the NDRC became part of a new Office of Scientific Research and Development, also headed by Bush, with Compton in charge of those divisions concerned with radar, radar countermeasures, guided missiles, optics, and physics.

Compton chaired the United States Radar Mission to the United Kingdom in 1943 as well as the committee that received a similar British mission to the United States in the following year. From 1943 to 1945 he was Chief of the Office of Field Service of OSRD, and in 1945 he was scientific adviser to General MacArthur and head of the Pacific Branch of the OSRD in Manila. With the official Japanese surrender on September 1, 1945, Compton left Manila for Japan as a member of a Scientific Intelligence Mission.

Throughout these busy years, he was called upon for committees and advisory boards on a variety of subjects—production of synthetic rubber, military training, weapons, and chemical warfare—and served on the Secretary of War's Special Advisory Committee on the Atomic Bomb.

Nor did demands from Washington cease when the war was over. President Truman appointed Compton to a committee on the atomic bomb test, and he was chairman of the Joint Chiefs of Staff's Evaluation Board for such tests. In 1946 he became chairman of the President's Advisory Commission on Military Training and from 1946 to 1948 was a member of the Naval Research Advisory Committee.

Despite continued demands from Washington, Compton managed to turn his attention once again to the affairs of MIT, whose needs had been profoundly affected by World War II. He also found time to serve as a trustee of the Ford, Rockefeller, and Sloan Foundations, the Sloan-Kettering Institute, the Brookings Institution, and Princeton University, to name but a few of a long list of philanthropic and government activities dating back to the thirties.

In 1948, answering still another call from Washington, he agreed to succeed Vannevar Bush as chairman of the Joint Research and Development Board, an agency designed to oversee military scientific research efforts in the postwar period. But a year later, for reasons of health, he was forced to relinquish the post. Having resigned the presidency of MIT and been elected chairman of its Corporation in 1948, he returned to Cambridge in November 1949.

## HONORS AND AWARDS

The many awards that rightfully came to Karl Compton throughout his life honored all that he did for his country and his countrymen and recognized long and faithful service in the cause of science, engineering, and education. In awarding him the Marcellus Hartley Medal[1] in 1947, the Academy cited his "eminence in the application of science to the public welfare," both for his contributions—as a physicist and an administrator—to the nation's "wartime research effort . . . and in the reinforcing of collaboration and understanding between civilian scientists and military men."

In 1946 he received the highest civilian honor of the U.S. Army, the Medal for Merit, for personally "hastening the termination of hostilities," particularly by means of the radar research and development program he directed. In 1948 he was named Honorary Commander, Civil Division, of the Most Excellent Order of the British Empire, and Knight Commander of the Norwegian Order of St. Olaf. He was promoted to Officer in the French Legion of Honor in 1951.

The Washington Award of the Western Society of Engineers came in 1947, the Lamme Medal of the American Society for Engineering Education in 1949, and in 1950, the Hoover Medal—a joint award of the American Institute of Electrical Engineers, American Society of Mechanical Engineers, American Institute of Mining and Metallurgical Engineers, and American Society of Civil Engineers.

His contributions as a physicist were especially recognized by the Rumford Gold and Silver Medals of the American Academy of Arts and Sciences in 1931, the William Proctor Prize for Scientific Achievement of the Scientific Research Society of America in 1950, and the Priestley Memorial Award of Dickinson College in 1954 for his contributions to "the welfare of mankind through physics."

Compton was also the holder of thirty-two honorary degrees, the one from Princeton (in 1930) aptly stating that "he merits honors the more because he counts them less than the satisfaction of work well done."

## IN CONCLUSION

In New York for a meeting in June 1954, Compton suffered a heart attack. Six days later, on June 22, a massive blood clot ended his life. Three children survive: Mary Evelyn (Mrs. Bissell Alderman) from his marriage to Rowena Rayman; and—from his marriage to Margaret Hutchinson, who died in 1980—Jean (Mrs. Carroll W. Boyce) and Charles Arthur. There are also several grandchildren and great-grandchildren.

A figure of great dignity and tremendous strength of character, Karl Compton made an enormous contribution to the intellectual and scientific development of our country in one of its most critical periods. His stature stems from his visionary ideas on science and education and his response to the great currents of thought that were stirring men's minds in his day.

To grasp the full range and depth of Compton's character, one must recognize how it molded the thinking and actions of those who shared his intellectual environment. A brilliant experimental physicist, an inspiring teacher, a great academic leader, a conscientious public servant, he was beyond all these a wise and dedicated statesman of science, vigorous in thought, deeply rooted in religious tradition, and utterly fearless in expressing what he believed to be true and right. To every effort he brought a full measure of extra strength—warmth of friendship and understanding, firmness of character, modesty, and effective administrative skill.

He has been described as a great American. He was a great, and responsible, human being as well.

## NOTE

1. Today known as the National Academy of Sciences Public Welfare Medal, the Academy's highest honor, and the only award presented on behalf of the entire Academy membership.

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