Scientific Accomplishments

In the late nineteenth century, physicians attributed the agglutination that regularly followed blood transfusions to underlying disease in the donor blood, but in 1900, Landsteiner began to consider an alternative explanation. Suspecting that transfusion between even healthy individuals may result in clotting, he proposed that humans may belong to different blood groups characterized by distinct antigens and corresponding antibodies with reactivity against other blood groups. To test this possibility, Landsteiner prepared 36 pairwise samples of blood and serum collected from the six members of his laboratory, including himself. By analyzing the pairs that agglutinated and those that did not, he deduced that humans belonged to at least three different blood groups that are now designated as A, B, and O. Landsteiner surmised that catastrophic outcomes of human blood transfusions occurred only when the recipient received blood of a different group. His discovery made possible much safer transfusions and paved the way for the use of blood type in forensic investigations and paternity tests.

Landsteiner continued to make significant contributions to the fields of immunology and serology long after his discovery of blood groups. He is renowned for elucidating the disorder known as paroxysmal hemoglobinuria and for becoming one of the first scientists to prepare purified antibodies. He also contributed important discoveries to the study of infectious diseases. In 1905 and 1906, he successfully infected monkeys with syphilis, providing an animal model for study of the disease. He pioneered the use of dark-field microscopy to identify and examine the spirochetes that cause syphilis. In 1908, Landsteiner turned his attention to the cause of poliomyelitis. After conducting a postmortem examination of a child who had died of this disease, he and colleague Erwin Popper successfully transmitted polio to monkeys by injection of a filtrate of spinal-cord tissue from the young victim. The results of this experiment led Landsteiner and Popper to be among the first immunologists to postulate that the disease was caused by a virus.

After moving to the United States in the 1920s, Landsteiner continued his research on blood groups, identifying the M and N factors with Philip Levine (AAI ’25) in 1927 and the Rh factor with Alexander S. Wiener (AAI ’32) in 1940. This discovery of the Rh factor was credited with significant reductions in infant morbidity from Rh incompatibilities between mother and fetus unaddressed during pregnancy.

What Landsteiner was said to be proudest of, however, was his work on antigen specificity.
that laid the foundation for the field of immunochemistry. In 1904, he discovered what he called “haptens,” simple substances that could be combined with proteins to produce synthetic antigens, and he continued to publish articles on the topic throughout his career. The textbook in which he collected much of this research, first published in English in 1936, became a “bible” for many immunologists. Indeed, although Landsteiner received accolades for his discovery of blood groups, esteemed microbiologist Hans Zinsser (AAI ’17, president 1919–20) noted that it was “his studies upon the chemical modifications of the antigens” that would have the greatest impact on the field of immunology.

Landsteiner was admired by contemporaries for his breadth of scientific knowledge and interests. “The distinguishing characteristics of Landsteiner’s investigations are great originality of approach and an extraordinary mastery of the fundamental sciences,” Zinsser wrote in his 1931 Scientific Monthly tribute to Landsteiner. He argued that Landsteiner’s “extraordinary versatility” made him “one of the few great living scientists.” Michael Heidelberger (AAI ’35, president 1946–47, 1948–49) concurred. Shortly after Landsteiner’s death, Heidelberger wrote, “The time is passed when one man can know all of science. Karl Landsteiner was one of the last possessed of the tremendous intellect that could comprehend and, better still, use practically all of the scientific knowledge of his time.”

**Biography**

Karl Landsteiner was born on June 14, 1868, in Vienna. After earning his M.D. from the University of Vienna in 1891, Landsteiner spent five years studying under some of Europe’s leading organic chemists, including Emil Fischer in Würzburg, Eugen von Bamberger in Munich, and Arthur Hantzsch and Roland Scholl in Zurich. In 1896, he returned to Vienna as an assistant to Max von Gruber at the Institute of Hygiene, where he began his work in immunology. Two years later, he accepted an appointment as an assistant at the Pathological-Anatomical Institute at the University of Vienna. He remained at the institute until 1907, performing autopsies and pathological examinations and publishing more than 75 papers. From 1908 to 1918, Landsteiner continued his research as chief pathologist at the Wilhelmina Hospital, but, constrained by the shortage of resources for conducting scientific research in postwar Vienna, he explored options abroad, and, in 1919, he relocated to begin work as a pathologist at R. K. Ziekenhuis, a small hospital in The Hague.

Upon receiving Simon Flexner’s (AAI ’20) offer of a position at the Rockefeller Institute for Medical Research, Landsteiner moved with his family to New York in the spring of 1923. Naturalized as a U.S. citizen in 1929, Landsteiner spent two decades at the Rockefeller Institute, continuing his research there even after his 1939 change in status to member emeritus.

Landsteiner died on June 26, 1943, shortly after suffering a heart attack in his Rockefeller Institute laboratory. He was 75.

**Awards and Honors**

Landsteiner was a member of the Imperial Society of Physicians in Vienna (1902), the National Academy of Sciences (1932), and the American Philosophical Society (1935). He was an honorary foreign member of the German Academy of Sciences (1927) and the Royal Society (1941) and was named a Chevalier of the French Legion of Honor (1911).

In addition to the Nobel Prize, Landsteiner’s many honors include the Hans Aronson Foundation Prize (1926), the Paul Ehrlich Medal (1930), the Dutch Red Cross Medal (1933), and the Albert Lasker Clinical Medical Research Award (1946).
AAI Service

After joining AAI in 1922, Landsteiner played an active role in its leadership, serving as councilor (1926–27, 1928–33) and president (1927–28). He was equally involved in the early years of The Journal of Immunology, serving on the advisory board (1924–35), on the board of editors (1937–42), and as an associate editor (1943).

6 Owen, “Karl Landsteiner and the First Human Marker Locus,” 998; Schwarz and Dorner, “Karl Landsteiner and His Major Contributions to Haematology,” 564.
8 Ibid., 93.
9 Heidelberger, “Karl Landsteiner,” 176–210, quote from 177.
10 Ibid., 177–78.

*Photo: University of Maryland, Baltimore County, The American Association of Immunologists Records*