

Medicine in philately: Karl Landsteiner, the father of blood grouping

[Filatelide tıp: Karl Landsteiner, kan gruplarının kurucusu]

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ABSTRACT

Karl Landsteiner was one of the first scientists to study the processes of immunity and is known as the founder of serology. He discovered that there are different groups of human blood and established the ABO-system based on haemagglutination. This blood grouping made blood transfusion routine medical practice. In 1930, he was awarded the Nobel prize in physiology or medicine for his discovery of human blood groups. This paper provides an overview on the discovery of the blood grouping and the physician behind this discovery, **Karl Landsteiner**, through philately.

Key Words: Karl Landsteiner, blood typing, transfusion, history, philately

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ÖZET

Karl Landsteiner immunitenin basamaklarını araştıran ilk bilim adamlarından biridir ve serolojinin kurucusu olarak tanınır. İnsan kanının birden fazla tipi olduğunu kanıtlamış ve hemaglutinasyona dayanan ABO sistemini ortaya koymuştur. Kan gruplarının bulunuşu tıp uygulamasında kan transfüzyonunu rutin hale getirmiştir. Landsteiner bu buluşuyla, 1930 yılında tıp veya fizyoloji alanında Nobel ödülüne layık görülmüştür. Bu çalışma, filateli aracılığıyla kan gruplarının keşif sürecine ve bu keşfin arkasındaki hekim olan Karl Landsteiner'in hayatına genel bir bakış sunmayı hedeflemektedir.

Anahtar Kelimeler: Karl Landsteiner, kan grupları, transfüzyon, tarih, filateli

Çıkar Çatışması: Yazarların çıkar çatışması yoktur.

Introduction

Until 1900, it was known that blood transfusion often resulted in dangerous or fatal clumping of the red blood corpuscles. After a series of tests performed in his laboratory, Karl Landsteiner found out that the blood of two people under contact agglutinates, and in 1901 he found that this effect was due to contact of blood with blood serum. As a result he succeeded in identifying the three blood groups A, B and O (then he labelled C) of human blood. Landsteiner also found out that blood transfusion between persons with the same blood group did not lead to the destruction of blood cells, whereas this occurred between persons of different blood groups [1]. Today it is well known that persons with blood group AB can accept donations of the other blood groups, and that persons with blood group O can donate to all other groups. Individuals with blood group AB are referred to as *universal recipients* and those with blood group O are known as *universal donors*. These donor-recipient relationships arise due to the fact that persons with AB do not form antibodies against either blood group A or B. Further, because type O blood possesses neither characteristic A nor B, the immune systems of persons with blood group AB do not refuse the donation [2]. In today's blood transfusions only concentrates of red blood cells without serum are transmitted, which is of great importance in surgical practice. For his pioneering work, he is recognised as the father of transfusion medicine (Figure 1 a,b).

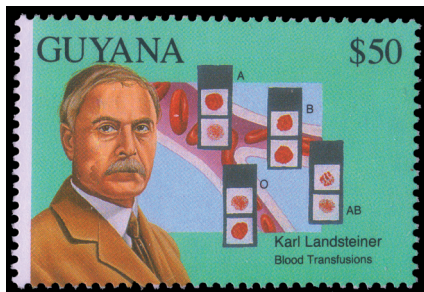


Figure 1 a. A stamp published in Guyana in 1982, showing Landsteiner, blood transfusion and blood grouping.



Figure 1 b. A special day cancellation sealed on the envelopes from Portugal, 17th of May 2007.

Early Years

Karl Landsteiner was born on 14 June 1868 in, in Vienna, Austria. He was the only child of Dr. Leopold Landsteiner, a famous journalist and the founder of the Vienna Daily Press. The family lived in Baden bei Wien, an upper-middle-class suburb of Vienna. Karl was four years old when his father died from a heart attack. He remained close to his mother, Fanny Hess, the rest of his life. He graduated in medicine from the University of Vienna in 1891. Besides the medical knowledge, Landsteiner had a big interest in the basic sciences, particularly chemistry. He gained further knowledge of chemistry by spending the next 5 years in the laboratories of Hantzschi at Zurich, Fischer at Wurzburg, and Bamberger at Munich [3]. Between 1896-1897, Landsteiner was an assistant to Max von Gruber, in the newly established Institute of Hygiene at the University of Vienna. At this Institute, he intensely interested in experimenting on bacterial agglutination, in serology and immunology and the nature of antibodies, and he now published his first papers on agglutination and immunology [4]. Landsteiner moved to Vienna's Institute of Pathology in 1897, where he was hired to perform autopsies. Here his new teacher was Anton Weichselbaum whose assistant he was from 1897 to 1908. Under Weichselbaum's supervision, Landsteiner conducted 3,639 post-mortem examinations and also began his work on serology (Figure 2), [3].

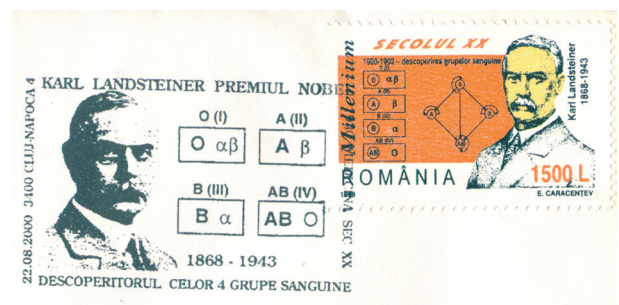


Figure 2. A stamp and a first day cancellation showing Landsteiner published in Romania in 2000.

Besides his major results in the field of serology, in 1908 he made one of the earliest landmarks in the conquest of polio. By taking pieces of the spinal cord of a polio victim and soaking them in liquid, he produced a mixture capable of infecting monkeys. Further work led him to observe that a virus caused the disease. Landsteiner's approach permitted laboratory investigation and experimentation, which is the initial step in gaining understanding and control of any infective organism [3].

In the field of immunology Landsteiner demonstrated the specificity of antibodies by introducing the concept of the hapten. Haptens are small organic molecules that can stimulate antibody production only when combined with a protein molecule. Landsteiner combined haptens

of known structures with such proteins as albumin and showed that small changes in the hapten would radically affect the production of antibodies [4].

During this period Landsteiner also worked on characterizing and evaluating the physiological meaning of cold agglutinations in human blood serum. In 1904 he and the Austrian internist Julius Donath (1870-1950) described a test for the diagnosis of paroxysmal cold haemoglobinuria. This test is now known as Donath-Landsteiner phenomenon or test (Figure 3 a,b), [5].



Figure 3 a. A stamp of Landsteiner published in Transkei in 1984.

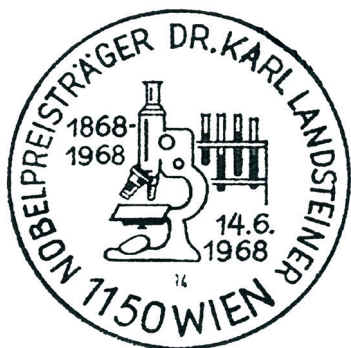


Figure 3 b. A special day cancellation from Austria in 1968 for the 100th birth anniversary of Landsteiner.

In 1905-1906 Landsteiner and Ernest Finger (1856-1939), then chief of the Clinic for Venereal Diseases and Dermatology in Vienna, were successful in infecting monkeys with syphilis, making possible experimentation with *Spirochaeta pallida*, the causal agent of the disease. In collaboration with the neurologist Otto Pötzl (1877-1962) and the serologist Rudolf Müller (1877-1934), they elucidated the previously unknown mechanism occurring in the Wassermann reaction (August Paul von Wassermann, German bacteriologist, 1866-1925). In 1906, Landsteiner and Viktor Mucha, a scientist from the Chemical Institute at Finger's clinic, developed the technique of dark-field microscopy to identify and study the microorganisms that cause syphilis. In the field of

bacteriology Landsteiner and Clara Nigg succeeded in 1930-1932 in culturing *Rickettsia prowazekii*, the causative agent of typhus, on living media [2].

Blood grouping

In 1875 it was reported that, when man is given transfusions of the blood of other animals, these foreign blood corpuscles are clumped and broken up in the blood vessels of man with the liberation of haemoglobin [6]. In 1901-1903 Landsteiner pointed out that a similar reaction may occur when the blood of one human individual is transfused, not with the blood of another animal, but with that of another human being, and that this might be the cause of shock, jaundice, and haemoglobinuria that had followed some earlier attempts at blood transfusions (Figure 4), [7].



Figure 4. A stamp about blood donation, published on the 27th of January 1964 in Bulgaria.

His suggestions, however, received little attention until, in 1909, he classified the bloods of human beings into the now well-known A, B, AB, and O groups and showed that transfusions between individuals of groups A or B do not result in the destruction of new blood cells and that this catastrophe occurs only when a person is transfused with the blood of a person belonging to a different group. Earlier, in 1901-1903, Landsteiner had suggested that, because the characteristics which determine the blood groups are inherited, the blood groups may be used to decide instances of doubtful paternity. Much of the subsequent work that Landsteiner and his pupils did on blood groups and the immunological uses they made of them was done, not in Vienna, but in New York [7]. In 1919, after the World War I, conditions in Vienna were such that laboratory work was very difficult and, seeing no future for Austria, Landsteiner obtained the appointment of Prosector to a small Roman Catholic Hospital at The Hague, Holland. Here he published, from 1919-1922, twelve papers on new haptens that he had discovered, on conjugates with proteins which were capable of inducing anaphylaxis and on related problems, and also on the serological specificity of the haemoglobins of different species of animals. His work in Holland came to an end when he was offered a position in the Rockefeller Insti-

tute for Medical Research in New York and he moved there together with his family. It was here that he did, in collaboration with Philip Levine (1900-1987), the further work on the blood groups which greatly extended the number of these groups, and Landsteiner and Levine announced the discovery of the M and N agglutinogens, also in collaboration with Wiener studied bleeding in the new-born, leading to the discovery of the Rh-factor in blood, which relates the human blood to the blood of the rhesus monkey. The discovery of blood groups made possible the safe transfusion of blood from one person to another [8]. The first successful transfusions were achieved in 1907 by Dr. Reuben Ottenberg (1882-1959) of Mt. Sinai Hospital, New York. In 1913, Richard Lewisohn (1875-1961), a surgeon at the Mount Sinai Hospital, discovered that adding citrates to blood prevented it from coagulating. This was the basis for his introduction of the modern technique of blood transfusion, and the last prerequisite for the establishment of the modern blood bank, since blood could now be preserved for two- to three-week periods under refrigeration (Figure 5), [6].



Figure 5. A special day cancellation showing blood groups, 22 April 2007 in Italy.

During World War I, transfusion of compatible blood was first performed on a large scale and saved many lives. Operations on the heart, lungs, and circulatory system, previously impracticable because of the magnitude of the blood loss

involved, were now feasible, as were complete blood exchanges in cases, for example, of intoxication or severe jaundice of the newborn. This paved the way for many other medical procedures that we don't even think twice about today, such as major surgery, blood banks, and transplants [8].

Landsteiner's work also added an important chapter to the development of legal medicine, providing admissible evidence in paternity suits and murder trials. In 1902 Landsteiner presented a lecture, together with Max Richter (1867-1932) of the Vienna University Institute

of Forensic Medicine, in which the two reported a new method of typing dried blood stains to help solve crimes in which blood stains are left at the scene (Figure 6), [8].



Figure 6. A stamp showing blood donation, published in Kenya on the 8'th of May, 1989.

Personal Life

It is known that Karl Landsteiner and his mother, Fanny Hess converted from Judaism to Catholicism when he was twenty one. In 1929 Landsteiner became a United States citizen while he was working at Rockefeller Institute in New York [9]. By all accounts, Landsteiner was a gentle and considerate man. Landsteiner was described as a modest, self critical, rather timid man known for his wide reading. He was also an excellent pianist. Over the years he became ever more committed to his work, and in his later years he had little time for friendships. Many years later, in his obituary of Landsteiner, Philip Levine described him as "He was an extraordinarily persistent, industrious and brilliant experimenter. When fascinated by a problem he could work day and night". Also, there is a citation from Landsteiner's own words: "Time is so short and there is so much to do. We must hurry." He always persevered and no matter what his circumstances, he would carve out a space to do research. Somewhat reclusive and pessimistic by nature, he felt at home in the laboratory and made it the focus of his life. Landsteiner's work schedule allowed little time for social activity. He was serving at a war hospital in 1916 when, at the age of 48, he married Leopoldine Helene Wlasto. Their only child, a son, was born the following year, Ernst Karl, on April 8, 1917 [10]. In 1930 he received the Nobel Prize in Physiology or Medicine. Some of the other awards and honours he got are; Hans Aronson Foundation Prize in 1926, Paul Ehrlich Medal for chemistry in 1932, Chevalier of the French Legion of Honour in 1933, Dutch Red Cross Medal in 1933 and Honorary doctorates from the University of Chicago (1927), Cambridge (1934), Université Libre de Bruxelles (1934), and Harvard (1936). He also became the President of the American Association of Immunologists in 1929 (Figure 7), [9].

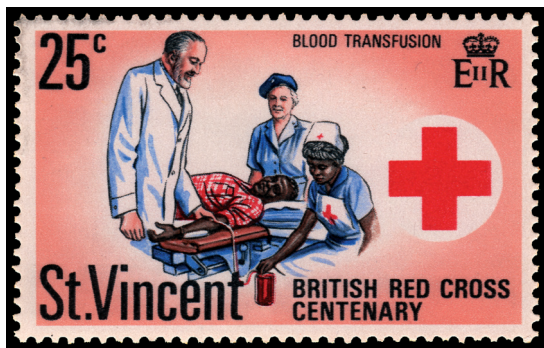


Figure 7. A stamp showing blood transfusion, published in St. Vincent, Caribbean on the 1st of June 1970.

Death

Landsteiner continued to work until 2 days before his death in 1943.

Landsteiner is known as the “melancholy genius” because he was so sad and intense, yet he was so systematic, thorough, and dedicated. He wrote 346 papers during his long career contributing to many areas of scientific knowledge [11]. Landsteiner was fortunate to be able to continue with creative scientific work virtually to the end of his life: he in fact suffered his fatal heart attack while working at his laboratory bench with a pipette in his hand on the 24th of June and two days later, on the 26th of June, 1943; aged 75 years, he died at at Rockefeller Institute in which he had done much of his landmark research.

Conflict of Interest: No conflict of interest was declared by the authors.

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