Karl Landsteiner: father of blood transfusion

Next time you take blood from a patient for grouping and cross-matching, or put up a blood transfusion, pause just for a moment and pay homage to Karl Landsteiner, who identified the human blood groups. This year marks the 150th anniversary of his birth, on 14 June 1868.

The first successful human blood transfusions were carried out by John Blundell, obstetrician at Guy's Hospital, London. After numerous experiments in dogs, he carried out nine human transfusions in the 1820s, five of which were successful. The first was in a woman dying of post-partum haemorrhage, who recovered after receiving blood from her husband. However, the problems were the clotting of the donor blood, which was later overcome by citration, and the severe, often fatal, reactions that could follow the transfusion. It was Landsteiner's work that was greatly to solve this problem.

Karl Landsteiner was born in Vienna on 14 June 1868. His father was a well-known newspaper editor and journalist, who died when Karl was only 6 years old. Landsteiner studied medicine at the University of Vienna, at the time when it was at the height of its fame as a centre of clinical and laboratory research, and qualified in 1891. For the next 2 years he studied chemistry both in Vienna and Wurzberg. He then became assistant in the Pathology Institute in Vienna. Here, until his promotion to Associate Professor of Pathological Anatomy in 1911, he produced a truly amazing corpus of research. This included numerous papers on serology, bacteriology, virology and pathological anatomy. As well as all this, he also performed 3600 autopsies.

In 1908, with co-workers Constantin Levaditi and Erwin Popper, he identified the virus of poliomyelitis. This was performed by injecting material from the ground-up spinal cord of a child who had died of poliomyelitis into the spinal cords of monkeys, who then went on to develop the disease.

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Landsteiner's work on blood groups commenced in 1900, when he showed that blood, in contact with blood serum from another subject, frequently underwent agglutination. In extensive experiments, he identified three blood groups, labelled A, B and O (which he had originally labelled 'C'). The antigens A or B form part of the surface of the erythrocyte and will produce agglutination if they come into contact with the serum of the other group. A subject of group O carries neither antigen and can therefore act as a 'universal donor'. Later, the less common blood group AB was recognized, accounting for some 3–4% of the population. These subjects have no serum agglutinins on their red blood corpuscles and can be regarded as 'universal recipients', able to receive blood from any of the four groups. Based on these findings, a successful transfusion using cross-matched blood was carried out at Mount Sinai Hospital, New York in 1907 and the modern era of safe blood transfusion began.

In 1930, Landsteiner received the Nobel Prize in Physiology or Medicine for this work.

Towards the end of World War I, and in the early days of the peace that followed, living conditions in Vienna seriously deteriorated. The thermostats in Landsteiner's laboratory, which were essential for his experiments, went out of action because of the shortage of fuel. The last straw was when a mob cut down the fences around his house and tore down the trees in his garden to use for fuel. So, in 1919, at the age of 51 years, Landsteiner moved with his wife and son to Holland.

Here, he obtained employment at a small Roman Catholic hospital in the Hague. In its small laboratory, assisted by a nun and a male servant, he performed autopsies, histological examinations and Wasserman reactions for syphilis. He also carried out research and published 12 papers, five of them in Dutch, in which he became fluent. However, the conditions for his work in Holland were little better than those he had left in Vienna, and in 1921 he accepted an invitation to work in the Rockefeller Institute for Medical Research in New York. Here, he learned to speak fluent English with the facility that he had mastered Dutch.

In New York, Landsteiner worked in his laboratory all day, using the lunch break to discuss their work with his assistants. The evenings were mainly spent writing or reading the scientific literature in the library. Much of his work involved the study of rare blood groups and work on the rhesus factor.

In 1941, in the dark days of the Second World War, came his election as a Foreign Member of the Royal Society. His last years were clouded by the fear that Nazi Germany might triumph.

The last year of Landsteiner's life was darkened by his wife's serious illness. In June 1943, he died suddenly of a massive coronary thrombosis; his wife outlived him by just a few months. Their only son, a graduate of Harvard Medical School, became a surgeon in Boston.

A remarkable life, combining a brilliant mind with a capacity for sheer hard work and crowned by research which is used by most of the readers of this article on a day-to-day basis. **BJHM**

Conflict of interest: none.

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