The secrets of blood, or the story of Ludwik Hirszfeld

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Whenever blood group systems are discussed, it is impossible to leave aside the figure of **Ludwik Hirszfeld (1884–1954), the Polish serologist and bacteriologist**, whose name is immortalized in the global history of medicine. The fact that not all blood is created equal was observed as early as in the 17th century, when the English physiologist Richard Lower and the French surgeon Jean-Baptiste Denys made the first fully documented attempts at blood transfusions. Some transfusions were carried out with no major problems, while others ended in disaster, which eventually led to a ban on performing transfusions in humans. It was not until the first half of the 19th century that the idea of a direct transfusion was revived, but the procedure was considered highly risky and thus performed rarely, in emergencies. Animal experimentation and theoretical deliberations were more common. The works of physicians such as **James Blundell (1790–1878), Johann Friedrich Dieffenbach (1792–1847) or Ludwik Bierkowski (1801–1860)** constituted a significant prelude to the development of modern transfusion medicine.

In the second half of the 19th century, due to the development of organic chemistry and physiological chemistry, the frontiers of knowledge about blood were pushed forward. Already at the end of the 18th century, the English naturalist and physician **William Charles Wells (1757–1817)** expressed his belief that the red color of blood must be caused by some pigment, although this was just speculation at that time. The Swedish chemist **Jöns Jacob Berzelius (1779–1848)** proved that the Englishman was right. He managed to isolate a pigment from blood, in which he detected the presence of oxidized iron. This was a significant step towards the isolation of hematin, which was discovered by **Gerardus Johannes Mulder**. On the other hand, the works of the chemist and physician **Friedrich Hünefeld (1799–1882)**, the physiologist **Otto Funke (1828–1879)** and the Polish anatomist **Ludwik Karol Teichmann (1823–1895)** resulted in the development of a method for obtaining the crystalline form of hemin **(called the Teichmann crystals)**, a significant breakthrough in blood chemistry research.

However, the question of why some transfusions have fatal outcomes, while others do not, still remained unanswered. This only changed in 1901 thanks to the Austrian pathologist **Karl Landsteiner**, who demonstrated the existence of two antigens on red blood cells, leading to distinguishing three blood groups, designated at the time as A, B and C (which is now known as 0). A fourth group, AB, was discovered one year later.

Ludwik Hirszfeld's scientific interests were extensive and included bacteriology, as well as immunology and genetics. Already during his studies in Berlin, he became more interested in research on the blood group system. His collaboration with **Emil von Dungern (1867–1961)**, which began in Heidelberg, would result in one of the key discoveries in the history of serology. While pondering the question of whether there is any permanent and determinable pattern of inheritance of a certain blood group system, Hirszfeld and Dungern developed a relevant model for scientific exploration. First, they conducted comparative studies in dogs,

and then they compared human blood samples. A total of nearly 350 individuals from 72 families living in Heidelberg were analyzed in this manner. They included a group of university professors and their relatives. Well-designed work soon yielded results. It was proved that a specific blood group is a permanent ontogenetic feature of each human and remains unchanged throughout life, and blood group inheritance is consistent with the laws of genetics established by **Gregor Mendel** in the 19th century. It was demonstrated that groups A and B are dominant, while group 0 is recessive. Publications authored by von Dungern and Hirszfeld dated 1910 and 1911 soon received publicity among scholars.

Hirszfeld again etched his name in the history of serology research during World War I, when together with his wife, Hanna, he carried out studies on the statistical distribution of blood groups among soldiers of different nationalities, which showed that in a study group of over 8 thousand men, group A was clearly predominant in Europeans, while group B was predominant in Asians. Hirszfelds' article was published in a reputable journal, The Lancet, in 1919. The text should be considered one of the significant origins of global seroanthropology.

Nine years later, during a meeting of the Committee on Hygiene of the League of Nations, it was Ludwik Hirszfeld who suggested that the nomenclature for groups in the A, B, 0 and AB system be adopted as universally applicable. Hirszfeld's postulate earned extensive approval. Somewhat earlier, in the years 1925–1926, he presented an original theory that was one of the first examples of a model for serological conflict between the mother and the fetus.

It should also be noted that while residing in the Balkans during World War I, Hirszfeld isolated previously unidentified bacterial strains that are responsible for paratyphoid fever (types A and C). The rod-shaped bacterium which causes paratyphoid fever C (also referred to as paratyphoid C) was named ***Salmonella hirschfeldii*** in honor of its discoverer.

When Poland regained independence, the Hirszfelds decided to return home. Ludwik established and managed the National Serum and Vaccine Research Institute. He was also actively involved in establishing the National Institute of Hygiene. He was a professor of the Free Polish University in Warsaw and since 1931 he was a titular professor of the University of Warsaw. After the September Campaign defeat, he remained in the capital. In 1941, the Hirszfelds were forced to move into the ghetto, where Ludwik not only dedicated himself to fighting infectious diseases, primarily epidemic typhus and tuberculosis, but also gave lectures for as long as possible. The Hirszfelds escaped from the ghetto in the summer of 1942 and survived the war thanks to the generous help offered by many people. In 1944, they found their way to Lublin. Ludwik Hirszfeld was one of the co-founders of the Maria Curie-Skłodowska University (MCSU), where he was the head of the Medical Microbiology Department. Then, Ludwik and Hanna headed to Wrocław, where they actively contributed to establishing the Polish university in this city from scratch. Same as in Lublin, Ludwik Hirszfeld took charge of the Microbiology Department. In the 1950s, he contributed greatly to establishing the Institute of Immunology and Experimental Therapy of the Polish Academy of Sciences, which now bears his name.

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References:

Czerwiński, U. Glensk (2019) *Mikroskopów nie trzyma się w szafie – o dokonaniach Ludwika Hirszfelda*, „Kosmos", 68 (2): 145-156.

Hirszfeldowa, A. Kelus, F. Milgrom (1956) *Ludwik Hirszfeld*, Warszawa.

Hirszfeld (2000) *Historia jednego życia*, Czytelnik, Warszawa.

Zwolski (2015) *Ludwik Hirszfeld* [w:] B. Orłowski (red.) *Polski wkład w przyrodoznawstwo i technikę. Słownik polskich i związanych z Polską odkrywców, wynalazców oraz pionierów nauk matematyczno-przyrodniczych i techniki* Warszawa, 2: 39-41.