Karl Landsteiner: The Map of Our Blood (A, B, O) (1930)

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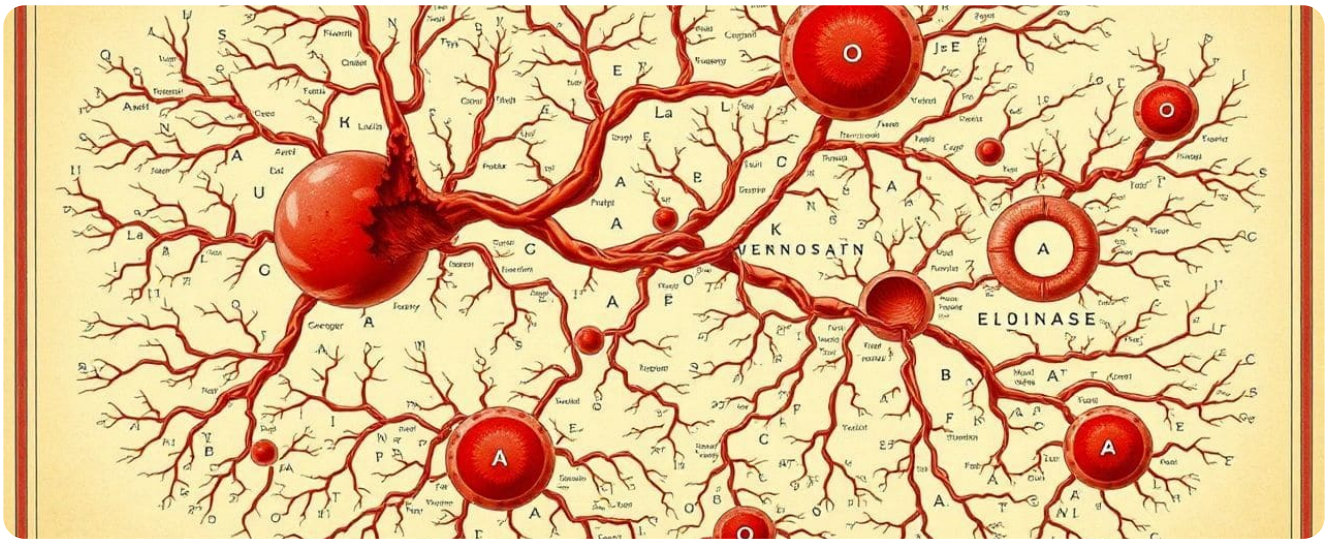

Vienna, 1900. A city of steaming cafés, waltzes in grand halls, and shadows stretching under gas lamps. In a small laboratory at the Pathological Institute, a thin man with a fine mustache and piercing eyes watches in frustration as another patient dies after a transfusion. His name is Karl Landsteiner, and that night, as he meticulously writes in his notebook, he doesn't yet know he's about to unravel one of the deepest mysteries of the human body:**why does blood sometimes save lives and other times destroy them?**

The scene repeats itself over and over. In 1875, a German doctor, Leonard Landois, had documented something terrifying: when he mixed blood from two different animals in a test tube, the red blood cells clumped together like rotten grapes, forming dark clots. But the worst was when he tried the same with humans. Some patients improved instantly after receiving new blood; others suffered chills, fever, and, in the worst cases, died with their kidneys blocked by those same clots.**It was as if blood had a secret code that only some could decipher.**

Landsteiner, obsessed with order and patterns, decides to investigate. In 1901, he gathers six colleagues from the lab: Dr. Pletschnig, Dr. Sturli, and four others whose names history almost forgets. He asks them to draw blood from one another, like guinea pigs. With glass pipettes, he mixes drops of blood on porcelain plates and observes. What he discovers leaves him breathless:**not all human blood is the same.**

- Sturli's blood makes Pletschnig's cells clump together like magnets.
- But Landsteiner's blood doesn't react with Sturli's.
- And another colleague, Dr. Zar, has blood that doesn't mix well with any of the others.

In just a few weeks, Landsteiner identifies three types of blood. He calls them A, B, and C (later, C would be renamed O). But there's a fourth type, rarer, which he discovers years later: AB.**It's the first map of human blood, a system of compatibilities that will save millions of lives.**

Yet the world doesn't listen right away. In 1907, an American surgeon, Reuben Ottenberg, reads Landsteiner's papers and performs the first successful transfusion using this system. But even then, many doctors prefer to rely on luck or archaic methods, like transfusing animal blood. Until World War I breaks out in 1914, and field hospitals fill with bleeding soldiers.**How is it possible that something as vital as blood has such strict rules? And why did nature design this system of incompatibilities?**

The Hidden Code in Our Veins

To understand Landsteiner's discovery, imagine blood as a miniature army. Red blood cells are the soldiers, tasked with carrying oxygen. But on the surface of each cell, there are tiny chemical flags called**antigens**(from the Greek "anti," against, and "genos," to generate). These flags are like uniforms identifying which group each soldier belongs to.

- In type A blood, cells carry "A"-shaped flags.
- In type B, they carry "B"-shaped flags.
- In type AB, they carry both flags.
- In type O, they carry no flags at all.

But here's the fascinating part: our bodies also produce**antibodies**, which act like security guards. These antibodies patrol the blood, searching for foreign flags. If they find a flag they don't recognize, they attack. For example:

- If you have type A blood, your body produces anti-B antibodies. If you receive type B blood, your antibodies will attack it, causing the cells to clump together.

- If you have type O blood, you produce both anti-A and anti-B antibodies. You can only receive type O blood, because any other flag will trigger your guards.

- If you have type AB blood, you produce no antibodies against A or B. You can receive any blood type, but you can only donate to other ABs.

Landsteiner didn't know this in 1901, but he had discovered the immune system in action. His finding explained why some transfusions worked and others killed:**it was a chemical war inside the veins.**

The Experiment That Changed Everything

On the night of November 14, 1901, Landsteiner wrote in his notebook: "Sturli's red blood cells agglutinate with Pletschnig's serum, but not with mine." That seemingly simple observation was the key. To confirm it, he repeated the experiment with 22 more people, including his wife, Leopoldine. The results were consistent: blood divided into groups.

But Landsteiner didn't stop there. In 1902, two of his students, Alfred von Decastello and Adriano Sturli (yes, the same Sturli from the original experiment), discovered a fourth blood type: AB. This type is rare, present in less than 5% of the population, but crucial. People with AB blood are "universal recipients": they can receive blood from any type without their antibodies attacking.

The paper Landsteiner published in 1901, titled*On the Agglutination of Normal Human Blood*, went almost unnoticed. The medical community was more interested in theories about miasmas and humors than in a system of blood compatibility. But Landsteiner didn't give up. In 1909, along with his colleague Erwin Popper, he discovered the polio virus, proving that science could unravel the deepest mysteries of the body.

The War That Saved Lives

World War I (1914-1918) was a turning point. In field hospitals, doctors faced a brutal reality: soldiers were bleeding to death because they didn't know which blood types were compatible. Then, in 1915, a Canadian doctor, Lawrence Bruce Robertson, began using Landsteiner's system for direct arm-to-arm transfusions. The results were astonishing: the survival rate of the wounded increased dramatically.

But there was a problem: a compatible donor wasn't always available. In 1916, an American doctor, Francis Peyton Rous, and his colleague J.R. Turner discovered that blood could be stored for days if mixed with sodium citrate, an anticoagulant. This allowed the creation of the first "blood banks." However, stored blood was still a scarce resource, and many doctors preferred riskier methods, like transfusing animal blood.

The situation changed in 1930, when Landsteiner received the Nobel Prize in Medicine. By then, his discovery had already saved countless lives, but the official recognition turned him into a global figure. That same year, a Russian doctor, Sergei Yudin, performed the first successful transfusion using blood from a corpse. Though the method was controversial, it proved that blood could come from unexpected sources.

The Legacy of an Obsessed Man

Karl Landsteiner died in 1943, at the age of 75, in New York. By then, his blood group system was universal. But his legacy went beyond transfusions. In 1940, along with Alexander Wiener, he discovered the Rh factor, another antigen present in blood that explained why some mothers rejected their own babies during pregnancy. This finding saved thousands of newborns from hemolytic disease of the fetus.

Today, the ABO system is so fundamental that we take it for granted. But in 1901, it was an unsolved puzzle. Landsteiner didn't just find the pieces; he fit them together with astonishing precision. His story reminds us that**great discoveries don't always arrive with fanfare**. Sometimes, they're born from the curiosity of one man in a small laboratory, mixing drops of blood on porcelain plates, while the world moves on without noticing.

Final Reflection: Why Does This Matter Today?

The ABO system isn't just a medical detail. It's a window into our evolution. Scientists believe that type O, the most common, emerged in Africa tens of thousands of years ago as an adaptation to diseases like malaria. Types A and B appeared later, possibly in response to bacterial infections. Even today, studies suggest that certain blood types may influence susceptibility to diseases like cholera or COVID-19.

But beyond science, Landsteiner's discovery is a lesson in humility.**Our bodies are miniature universes, with rules so complex that we're still uncovering them today.**And every drop of blood carries a story of survival, adaptation, and, above all, connection. Because in the end, what Landsteiner taught us is that, though not all blood is compatible, we all share the same miracle: life flowing through our veins.