

## INTRODUCTORY NOTES

*This article is a transcript of an 'In Depth Tutorials and Information' post in the 'What-When-How' series, which is reproduced here in this format for convenience and as an additional source of information for personal study relating to the history of blood transfusion. The original article can be accessed at:*

<http://what-when-how.com/inventions/blood-transfusion-inventions/>

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*After a brief historical introduction the article identifies four American people who are stated to be 'behind the invention' of transfusion. Whilst this claim is obviously oversimplistic as it stands, the article goes on to provide interesting historical information regarding two of them, Charles Drew and George Washington Crile, who were both key figures in the development of direct blood transfusion techniques in America.*

## BLOOD TRANSFUSION (INVENTIONS)

**The invention:** A technique that greatly enhanced surgery patients' chances of survival by replenishing the blood they lose in surgery with a fresh supply.

The people behind the invention:

### **The people behind the invention**

Charles Drew (1904-1950), American pioneer in blood transfusion techniques  
George Washington Crile (1864-1943), an American surgeon, author, and brigadier general in the U.S. Army Medical Officers' Reserve Corps  
Alexis Carrel (1873-1944), a French surgeon  
Samuel Jason Mixter (1855-1923), an American surgeon

### **Nourishing Blood Transfusions**

It is impossible to say when and where the idea of blood transfusion first originated, although descriptions of this procedure are found in ancient Egyptian and Greek writings. The earliest documented case of a blood transfusion is that of Pope Innocent VII (*sic*). In April, 1492, the pope, who was gravely ill, was transfused with the blood of three young boys. As a result, all three boys died without bringing any relief to the pope.

In the centuries that followed, there were occasional descriptions of blood transfusions, but it was not until the middle of the seventeenth century that the technique gained popularity following the English physician and anatomist William Harvey's discovery of the circulation of the blood in 1628. In the medical thought of those times, blood transfusion was considered to have a nourishing effect on the recipient. In many of those experiments, the human recipient received animal blood, usually from a lamb or a calf. Blood transfusion was tried as a cure for many different diseases, mainly those that caused hemorrhages, as well as for other medical problems and even for marital problems.

Blood transfusions were a dangerous procedure, causing many deaths of both donor and recipient as a result of excessive blood loss, infection, passage of blood clots into the circulatory systems of the recipients, passage of air into the blood vessels (air embolism), and transfusion reaction as a result of incompatible blood types. In

the mid-nineteenth century, blood transfusions from animals to humans stopped after it was discovered that the serum of one species agglutinates and dissolves the blood cells of other species. A sharp drop in the use of blood transfusion came with the introduction of physiologic salt solution in 1875. Infusion of salt solution was simple and was safer than blood transfusion.

### **Direct-Connection Blood Transfusions**

In 1898, when George Washington Crile began his work on blood transfusions, the major obstacle he faced was solving the problem of blood clotting during transfusions. He realized that salt solutions were not helpful in severe cases of blood loss, when there is a need to restore the patient to consciousness, steady the heart action, and raise the blood pressure. At that time, he was experimenting with indirect blood transfusions by drawing the blood of the donor into a vessel, then transferring it into the recipient's vein by tube, funnel, and cannula, the same technique used in the infusion of saline solution.

The solution to the problem of blood clotting came in 1902 when Alexis Carrel developed the technique of surgically joining blood vessels without exposing the blood to air or germs, either of which can lead to clotting. Crile learned this technique from Carrel and used it to join the peripheral artery in the donor to a peripheral vein of the recipient. Since the transfused blood remained sealed in the inner lining of the vessels, blood clotting did not occur.

The first human blood transfusion of this type was performed by Crile in December, 1905. The patient, a thirty-five-year-old woman, was transfused by her husband but died a few hours after the procedure.

The second, but first successful, transfusion was performed on August 8, 1906. The patient, a twenty-three-year-old male, suffered from severe hemorrhaging following surgery to remove kidney stones. After all attempts to stop the bleeding were exhausted with no results, and the patient was dangerously weak, transfusion was considered as a last resort. One of the patient's brothers was the donor. Following the transfusion, the patient showed remarkable recovery and was strong enough to withstand surgery to remove the kidney and stop the bleeding. When his condition deteriorated a few days later, another transfusion was done. This time, too, he showed remarkable improvement, which continued until his complete recovery.

For his first transfusions, Crile used the Carrel suture method, which required using very fine needles and thread. It was a very delicate and time-consuming procedure. At the suggestion of Samuel Jason Mixter, Crile developed a new method using a short tubal device with an attached handle to connect the blood vessels. By this method, 3 or 4 centimeters of the vessels to be connected were surgically exposed, clamped, and cut, just as under the previous method. Yet, instead of suturing of the blood vessels, the recipient's vein was passed through the tube and then cuffed back over the tube and tied to it. Then the donor's artery was slipped over the cuff. The clamps were opened, and blood was allowed to flow from the donor to the recipient. In order to accommodate different-sized blood vessels, tubes of four different sizes were made, ranging in diameter from 1.5 to 3 millimeters.

### **Impact**

Crile's method was the preferred method of blood transfusion for a number of years. Following the publication of his topic on transfusion, a number of modifications to the original method were published in medical journals. In 1913, Edward Lindeman

developed a method of transfusing blood simply by inserting a needle through the patient's skin and into a surface vein, making it for the first time a nonsurgical method. This method allowed one to measure the exact quantity of blood transfused. It also allowed the donor to serve in multiple transfusions. This development opened the field of transfusions to all physicians. Lindeman's needle and syringe method also eliminated another major drawback of direct blood transfusion: the need to have both donor and recipient right next to each other.

### **Charles Drew**

While he was still in medical school, Charles Richard Drew saw a man's life saved with a blood transfusion. He also saw patients die because suitable donors could not be found. Impressed by both the life-saving power of transfusions and the dire need for more of them, Drew devoted his career to improving the nation's blood supply. His inventions saved untold thousands of lives, especially during World War II, before artificial blood was developed.

Born in 1904 in Washington, D.C., Drew was a star athlete in high school, in Amherst College – from which he graduated in 1926 – and even in medical school at McGill University in Montreal from 1928 to 1933. He returned to the U.S. capital to become a resident in Freedmen's Hospital of Howard University. While there he invented a method for separating plasma from whole blood and discovered that it was not necessary to recombine the plasma and red blood cells for transfusion. Plasma alone was sufficient, and by drying or and freezing it, the plasma remained fresh enough over long periods to act as an emergency reserve. In 1938 Drew took a fellowship in blood research at Columbia Presbyterian Hospital in New York City. Employing his plasma preservation methods, he opened the first blood bank and wrote a dissertation on his techniques. He became the first African American to earn a Doctor of Science degree from Columbia University in 1940.

He organized another blood bank, this one in Great Britain, and in 1941 was appointed director of the American Red Cross blood donor project. However, Drew learned to his disgust that the Red Cross and U.S. government would not allow blood from African Americans and Caucasians to be mixed in the blood bank. There was no scientific reason for such segregation. Bias prevailed. Drew angrily denounced the policy at a press conference and resigned from the Red Cross. He went back to Howard University as head of surgery and, later, director of Freedmen's Hospital. Drew died in 1950 following an automobile accident.