Alexis Carrel

Born: 1873
Died: 1944
Nationality: French
Occupation: medical scientist

Alexis Carrel was an innovative surgeon whose experiments with the transplantation and repair of body organs led to advances in the field of surgery and the art of tissue culture. An original and creative thinker, Carrel was the first to develop a successful technique for suturing blood vessels together. For his work with blood-vessel suturing and the transplantation of organs in animals, he received the 1912 Nobel Prize in medicine and physiology. Carrel's work with tissue culture also contributed significantly to the understanding of viruses and the preparation of vaccines. A member of the Rockefeller Institute for Medical Research for thirty-three years, Carrel was the first scientist working in the United States to receive the Nobel Prize in medicine and physiology.

Carrel was born on June 28, 1873, in Sainte-Foy-les-Lyon, a suburb of Lyons, France. He was the oldest of three children, two boys and a girl, in a Roman Catholic family. His mother, Anne-Marie Ricard, was the daughter of a linen merchant. His father, Alexis Carrel Billiard, was a textile manufacturer. Carrel dropped his baptismal names, Marie Joseph Auguste, and became known as Alexis Carrel upon his father's death when the boy was five years old. As a child, Carrel attended Jesuit schools. Before studying medicine, he earned two baccalaureate

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degrees, one in letters (1889) and one in science (1890). In 1891, Carrel began medical studies at the University of Lyons. For the next nine years, Carrel gained both academic knowledge and practical experience working in local hospitals. He served one year as an army surgeon with the Alpine Chasseurs, France's mountain troops. He also studied under Leo Testut, a famous anatomist. As an apprentice in Testut's laboratory, Carrel showed great talent at dissection and surgery. In 1900, he received his medical degree but continued on at the University of Lyons teaching medicine and conducting experiments in the hope of eventually receiving a permanent faculty position there.

Early Success with Blood Vessel Sutures

In 1894, the president of France bled to death after being fatally wounded by an assassin in Lyons. If doctors had known how to repair his damaged artery, his life may have been saved, but such surgical repair of blood vessels had never been done successfully. It is said that this tragic event captured Carrel's attention and prompted him to try and find a way to sew severed blood vessels back together. Carrel first taught himself how to sew with a small needle and very fine silk thread. He practiced on paper until he was satisfied with his expertise, then developed steps to reduce the risk of infection and maintain the flow of blood through the repaired vessels. Through his careful choice of materials and long practice at various techniques, Carrel found a way to suture blood vessels. He first published a description of his success in a French medical journal in 1902.

Despite Carrel's growing reputation as a surgeon, he failed to acquire a faculty position at the university. His colleagues seemed indifferent to his research, and Carrel, in turn, was critical of the French medical establishment. The final split between Carrel and his peers came when Carrel wrote a positive account of a miracle he apparently witnessed at Lourdes, a small town famous since 1858 for its Roman Catholic shrine and often visited by religious pilgrims. In his article, Carrel suggested that there may be medical cures that cannot be explained by science alone, and that further investigation into supernatural phenomena such as miracles was required. This conclusion pleased neither the scientists nor the churchmen of the day.

In June, 1904, Carrel left France for the French-speaking city of Montreal, Canada; an encounter with French missionaries who had worked in Canada had sparked Carrel's interest in that country several years earlier. Shortly after his arrival, Carrel accepted an assistantship in physiology from the Hull Physiology Laboratory of the University of Chicago, where he remained from 1904 to 1906. The university provided him with an opportunity to continue the experiments he had begun in France.

Blood transfusion and organ transplantation seemed within reach to Carrel, now that he had mastered the ability to suture blood vessels. In experiments with dogs, he performed successful kidney transplants. His bold investigations began to attract attention not only from other medical scientists but from the public as well. His work was reviewed in both medical journals and popular newspapers such as the NEW YORK HERALD. In the era of Ford, Edison, and the Wright Brothers, the public was easily able to imagine how work in a scientific laboratory could lead to major changes in daily life. Human organ transplantation and other revolutions in surgery did not seem far off.

Begins Lifetime Career at Rockefeller Institute

In 1906, the opportunity to work in a world-class laboratory came to Carrel. The new Rockefeller Institute for Medical Research (now named Rockefeller University) in New York City offered him a position. Devoted entirely to medical research, rather than teaching or patient care, the Rockefeller Institute was the first institution of its kind in the United States. Carrel would remain at the institute until 1939. At the Rockefeller Institute, Carrel continued to improve his methods of blood-vessel surgery. He knew that mastering those techniques would allow for great advances in the treatment of disorders of the circulatory system and wounds. It also made direct blood transfusions possible at a time when scientists did not know how to prevent blood from clotting. Without this knowledge, blood could not be stored or transported. In the JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION in 1910, Carrel described connecting an artery from the arm of a father to the leg of an infant in order to treat the infant's intestinal bleeding. Although the experiment was a success, the discovery of anticoagulants soon made such direct transfer unnecessary. For his pioneering efforts, Carrel won the Nobel Prize in 1912.

Carrel's success with tissue cultures through animal experiments led him to wonder whether human tissues and even whole organs, might be kept alive artificially in the laboratory. If so, lab-raised organs might eventually be used as substitutes for diseased parts of the body. The art of keeping cells and tissue alive, and even growing, outside of the body is known as tissue culture. Successfully culturing tissue requires great technical skill. Carrel was particularly interested in perfusion -- a procedure of artificially pumping blood through an organ to keep it viable. Carrel's work with tissue culture contributed greatly to the understanding of normal and abnormal cell life. His techniques helped lay the groundwork for the study of viruses and the preparation of vaccines for polio, measles, and other diseases. Carrel's discoveries, in turn, built upon the successes of, among others, Ross G. Harrison, a contemporary anatomist at Yale who worked with frog tissue cultures and transplants.

One of Carrel's experiments in tissue culture became the subject of a sensationalized news story and was viewed as a monstrosity by the public. In 1912, Carrel took tissue from the heart of a chicken embryo to demonstrate that warm-blooded cells could be kept alive in the lab. This tissue, which was inaccurately depicted as a growing, throbbing chicken heart by some newspapers, was kept alive for thirty-four years -- outliving Carrel himself -- before it was deliberately terminated. The WORLD TELEGRAM, a New York newspaper, annually marked the so-called chicken heart's "birthday" each January.

Though working in the United States, Carrel had not bought a house there, and did not become a U.S. citizen. Rather, he spent each summer in France, and on December 26, 1913, Carrel married Anne-Marie Laure (Gourlez de la Motte) de Meyrie, a widow with one son, in a ceremony in Brittany. They had met at Lourdes, where Carrel made an annual pilgrimage each August. Eventually, the couple bought some property on the island of Saint Gildas off the coast of Brittany, and lived in a stone house there. They had no children together.

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