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Alexis Carrel (1873–1944) and Dakin's Solution

The story of the French surgeon behind the antiseptic credited to Dakin alone

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ABSTRACT

The author calls for historical justice to be done to Dakin's solution, a sodium hypochlorite antiseptic, by recognizing that it was jointly developed by the chemist Henry Drysdale Dakin and the surgeon Alexis Carrel during the First World War. The text recounts Carrel's biography: born in France in 1873, a pioneer of vascular suture and microsurgery, inventor of techniques still in use, and winner of the 1912 Nobel Prize for his research in vascular surgery. It describes his arrogant personality, the feuds with former teachers who blocked his career in France, and his work in the United States and at the Rockefeller Institute, including tissue culture and a blood-circulation pump. It also relates his ties to the Vichy government and his death in 1944, a few hours before he was to be arrested on a never-proven charge of collaboration.

KEYWORDS: *alexis carrel; dakin's solution; sodium hypochlorite; vascular surgery; history of medicine; nobel prize*

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Historical justice ought to be done, and Dakin's liquid or fluid should bear the name of both the English chemist Henry Drysdale Dakin and the French surgeon Alexis Carrel. It is a buffered aqueous solution of sodium hypochlorite, diluted to 0.5%, used throughout the world as an antiseptic and known simply as Dakin's liquid or fluid.

Working together, the two professionals developed the antiseptic in 1914 and 1915 during the First World War, near the front line at Compiegne, at the Rond-Royal Military Hospital, funded by the Rockefeller Institute for Medical Research. The research was carried out using different concentrations of the active principle, with the aim of finding an effective antiseptic. 1

Studying the life of Alexis Carrel, one comes to imagine that his name was indeed boycotted out of the picture over the years because of feuds that arose with his former teachers, who later became his commanding officers during the conflict.

Carrel was born in Saint Foy-les-Lyon. He was baptized with the name Auguste, but as soon as his father died (in 1877) he was given the name Alexis, in keeping with the custom of the time of honoring the dead. He studied at the Lyon School of Medicine, which he entered at the age of 17 in 1890, graduating in 1900. He had early on taken an interest in the technique of suturing vessels in dogs, devising the anchored triangular stitch as well as the curved needle that have been used for decades in vascular microsurgery. As an adolescent, he had frequented his mother's sewing circle and, as a medical student, returned to the group to observe how the ladies worked. He saw the applicability of their technique to vascular surgery and, even as a student, published papers describing his experiments in animals in this field.

In late 1893 he began his specialization in surgery, after a fierce competition for the three available places. He placed second among the 57 candidates. In June 1894 Carrel watched his professors in Lyon try, without success, to save the life of the French president Marie Francois

Sadi Carnot, who had been stabbed in the back by the Italian anarchist Sante Caserio. He harshly criticized them for failing to suture the portal vein, which had been struck by the assassin's blade. He had a difficult personality: he was arrogant and irascible. 2

His professors never forgave him for this, and even blocked any and every advancement in his career in France. In that same year, Carrel sought his fortune in the New World, working in the beef-cattle business in Montreal, Canada, where he was discovered and recognized as one of the pioneers of experimental vascular surgery. Two years earlier he had successfully sutured the ends of a severed artery. The Americans eventually drew him to the Hull Physiological Laboratory of the University of Chicago in 1905, where he began experiments on kidney transplants in animals. He was one of those responsible for publicizing the successful results of the cultivation of nerve cells outside the animal body, achieved in 1907 by Ross Granville Harrison of Yale and Johns Hopkins Universities. One of his assistants, Montrose Burrows, studying culture media, discovered that chicken plasma was ideal for human tissues. Carrel and Burrows worked together for two years before the latter moved to Cornell University.

In 1911 Carrel published his first article on tissue culture. It was considered highly important by the world's media, carefully cultivated by the vain author. He was keen on publicity!

On several occasions he was offered American citizenship, but he always politely declined, because he considered himself a French patriot.

For his research in vascular microsurgery, Alexis Carrel won, in 1912, the first Nobel Prize (at the time, 39 thousand dollars) in Medicine and Physiology for the United States. Carrel was so widely known for his tissue-culture studies that for some time it was thought the prize had been awarded to him for that reason, which outraged some scientists who knew of Harrison's precedence.

It is easy to understand why he met with reservations on both sides. It was a Frenchman, and not an American, who had won the coveted trophy in America. For the French, Carrel, French by birth, had won the prize for America and not for France.

In 1913 he married the nurse Anne Marie de la Meyrie, who was his great companion until the end of his life in 1944.

In 1914, as soon as the First World War broke out, he returned to France as a volunteer. His former teachers and adversaries were now high-ranking officers in the army's medical corps. The rancor had persisted through all those years, which greatly hindered Carrel's work in the hospitals. The results of his research, in partnership with Dakin, on the effectiveness of sodium hypochlorite as an effective antiseptic were only officially recognized and accepted by the French government at the end of 1915.

Once the conflict in Europe was over, Carrel resumed his post at the Rockefeller Institute for Medical Research in the United States and gradually rose to the position of full professor. In 1935 he published his famous book *Man, the Unknown* (another book was published posthumously in 1950: *Reflections on Life*). He continued his research on tissue culture and became more famous in this line than for vascular microsurgery. His lectures became very popular in the United States. In 1936 he developed a blood-circulation pump, which was considered the world's first artificial heart.

He retired from the Rockefeller Institute and returned to his beloved France at the time of the Second World War, in 1939, in order to make his contribution as a physician, not caring whether his patients were French, German, or English. The Vichy French government, a puppet of the Nazis, appointed him director general of a large hospital of the *Fondation Francaise pour l'Etude des Problemes Humains*, owing to his competence and worldwide fame.

With the Liberation in 1944, the witch hunt began, and the nationalists of the *Resistance*, led by De Gaulle, applied summary justice to all those identified as collaborators of the Vichy regime and the Nazis, shooting or imprisoning them. Marshal Petain, for example, a national hero of the First World War, spent the rest of his life in prison. 3

Although nothing was ever proven against him, Alexis Carrel was charged, and republican guards went to his residence to arrest him—an event widely announced on local radio, even though he had not been formally indicted. By an irony of fate, the scientist, 71 years old and already ill for some months, had died nine hours earlier.

Bibliography consulted: 1) MOSELEY, J. – Alexis Carrel, the man unknown. Journey of an idea. *Journal of the American Medical Association, 244*(10): 1119-21, Sept. 1980. 2) Entries on Alexis Carrel and Sadi Carnot in The New Encyclopaedia Britannica, Micropaedia, Vol.2, pp. 589 and 578 (respectively).

1 This hospital was destroyed by the Germans in March 1918 by aerial bombardment.

2 President Sadi Carnot was a very close friend of Dom Pedro II, having even arranged his funeral rites in 1891 when the latter died in Paris.

3 The Encyclopaedia Britannica reports that some 10,000 executions were said to have taken place at the time of the Liberation of France. After the reestablishment of justice, and in the two years that followed, 125,000 people were indicted, resulting in about 40,000 prison sentences and 700 to 800 death sentences. Nearly 50,000 individuals were punished with "national degradation" and loss of political rights for a variable number of years. (*The New Encyclopaedia Britannica, Macropaedia*, Vol.7, p. 676, 1980.)

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