

Remember When...

Miracle Blood Lubricant: Connaught & the Story of Heparin, 1928-1937

Connaught's involvement in the Insulin story is well known. However, Connaught's role in the equally important history of Heparin in the 1930s is much less appreciated. These dramatic events in medical history share many common elements linked by a strongly cooperative production, research and clinical relationship between Connaught, the University of Toronto's Department of Physiology, and the Toronto General Hospital. A central figure to both stories was **Dr. Charles H. Best** (1899-1978).

Heparin is a powerful blood anticoagulant that is essential for open heart surgery, organ transplants and for treating dangerous internal blood clots. Heparin was discovered in 1916 at Johns Hopkins University, but it was not practically applied by doctors until the early 1930s when a research team at Connaught, led by Best, developed a method to make available a purified, plentiful and inexpensive supply safe for human use.

The Toronto heparin story began in 1928-29 when Best, the new head of the U. of Toronto's Physiology Department and an Associate Director of Connaught, decided to break the heparin stalemate and explore its practical value. At the time only small amounts of heparin, made from dog liver, was available, but it was extremely expensive, toxic and unsafe for humans.

Best thus had two goals: *to find a method to produce large amounts of pure heparin; and study the effects of heparin in animals, and then humans, to control thrombosis.*

After early work proved encouraging, Best expanded his research team in 1929 to include **Drs. Arthur E. Charles** (1905-1972), a young organic chemist, and **David A. Scott** (1892-1971), who was closely involved in insulin production at Connaught. Soon after Charles and Scott began their work, **Dr. Gordon Murray** (1896-1976), a prominent surgeon at Toronto General Hospital, joined the team to conduct experimental surgery using heparin.

The first task of Charles and Scott was to find a cheaper source of heparin than dog liver. They turned to beef liver,

readily available from local slaughterhouses, and were successful in extracting significant amounts of heparin. This work was highly complex, as well as unpleasant since an important part of their method involved letting these tissues "autolyze," or spoil, before the extract could be prepared and purified. This forced much of the work from the School of Hygiene Building downtown, to the more open environment of Connaught's Dufferin "Farm." Charles and Scott first reported on this work in the fall of 1933, followed by studies of the still mysterious chemistry of heparin. Between 1933 and 1936, they succeeded in purifying and then crystallizing heparin into a standardized dry form that could be administered in a salt solution. Heparin thus became Connaught's second product, after insulin, to be recognized as an international biological standard.

Meanwhile, Murray conducted experimental surgery with various animals using Connaught's more potent heparin. He discovered that heparin definitely cleared up internal blood clots, and also seemed useful for many other dangerous operations where blood coagulated quickly. The next step was to try heparin on human patients under less predictable conditions. The first human trials began in May 1935 and soon involved hundreds of complex surgical cases during which Connaught's heparin played an essential and often dramatic life-saving role.

By 1937 it was clear that Connaught's heparin was a safe, easily available and effective blood anticoagulant. Best's heparin team had opened the door to such operations as organ transplants and open heart surgery, as well as the artificial kidney that was pioneered by Murray. Connaught continued to prepare heparin and worked to increase its potency and reduce its price. By 1949, **Drs. Peter Moloney** and **Edith Taylor** were successful and received a patent for their improved methods of heparin production. This work made heparin more easily produced elsewhere and by the early 1950s, Connaught had stopped producing the crucial life-saving product that it had pioneered.

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Dr. Charles H Best (1899-1978)

Dr. David A Scott (1892-1971)

Dr. Arthur F Charles (1905-1972)

