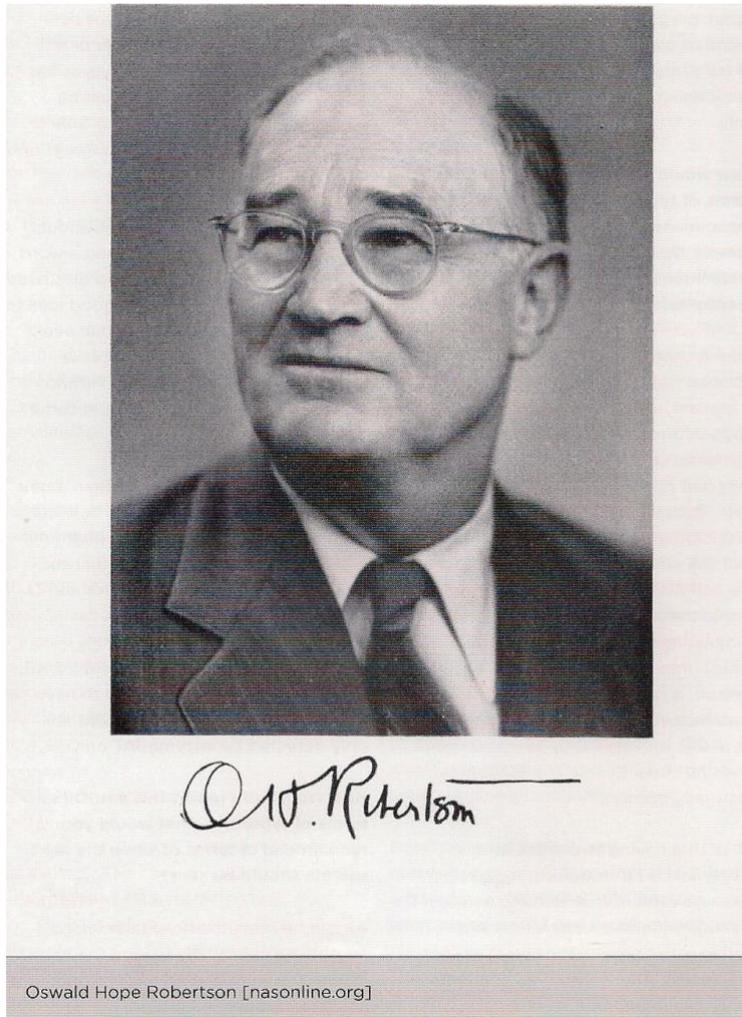


OSWALD HOPE ROBERTSON (1886-1966)

A version of this article, written by Phil Learoyd, was originally published in the British Blood Transfusion Society magazine *Bloodlines*

Whilst serving with the US Army Medical Corps, Oswald Hope Robertson pioneered the use of citrate-glucose stored blood in 'blood depots' at casualty clearing stations in 1917 in France during World War 1.



Although born in London, when Oswald ('Robbie') Robertson was 18 months old his parents moved to California and settled in the San Joaquin Valley. Having completed his medical degree at Harvard Medical School in 1913 he became an intern at Massachusetts General Hospital where he took an active interest in haematology, winning a Dalton post-graduate scholarship to study pernicious anaemia. He subsequently took a post as a research assistant in bacteriology and pathology at the Rockefeller Institute for Medical Research, where he planned to continue his studies on the physiology of blood in the laboratories of Dr. Peyton Rous.

However, when America entered the war in Europe, he enlisted with a medical team to serve with the American and British Expeditionary Forces in France. There he used a citrate-glucose solution that had been developed by Rous in the US, which

had been shown to prevent clotting whilst providing nourishment for red cells, enabling blood to be stored for several days *in vitro*. Robertson recognised the potential of using this solution for transfusing wounded soldiers and established a 'blood-depot' at the Fifth Base Station Hospital (casualty clearing station) where blood was collected from group O 'universal' donors (i.e. 'group IV' at that time) into a citrate-glucose solution prior to transfusion.

He collected only group O blood (which ensured that there was no need to perform 'agglutination tests' before transfusion) from soldiers who had only trivial or slight wounds (and who did not have a history of malaria, trench fever or syphilis) between periods of fighting. He stated that the chief value of using citrated stored blood was 'the convenience of having a large quantity of blood on hand for a rush' and that during periods of fighting 'it would have been difficult to give transfusions in the usual way not only on account of the time element involved, but also because of the scarcity of donors' [The "usual way" refers to a direct donor-recipient transfusion].

He lists some of the other advantages of using stored blood to being able to give blood at the bedside without having to move the patient; to not having the donor and recipient together (which takes up too much space); that the transfusion technique is simple, quick and easily to perform, and that it is possible to give a large amount of blood in a single transfusion. Robertson also developed an 'ice box' used for storing the blood, made using two wooden packing cases one inside the other with the space between the two boxes being filled with sawdust for insulation. The blood was stored for varying time periods but 'the majority of transfusions were given with blood preserved from ten days to two weeks'. The amounts given in a single transfusion varied from 500 cc to 1,000 cc depending on the patient, though the total volume transfused was also sometimes made up with a gelatin solution. He reported that patients transfused with stored blood showed improved colour, that their pulse became slower and stronger, that the blood pressure showed an increase of 20 to 40 points and that these improvements were maintained. He also noted that there were no reactions seen either during or after the transfusion. Robertson also transported units of stored blood via an ambulance 'for six or eight miles over rough roads' without any noticeable detrimental effects. However, he gave only twenty-two transfusions to twenty different patients. Many people would question why so few transfusions were performed. Perhaps the harrowing extract from his diary of the 30th – 31st November 1917 reproduced below may help to explain why:

By noon, the wounded began to arrive, then more and more till there was a solid string of ambulances extending down the road almost as far as you could see. We were simply deluged. We couldn't operate [on] more than a small fraction of the cases; we couldn't get rid of them as the ambulance trains were hung up several miles away - couldn't get thru because ammunition trains had the right of way. They piled up and piled up. The resuscitation ward was a veritable chamber of horrors - worse than anything before. Men were horribly mutilated - many were dying when brought in, an occasional one had already died by the time he reached the ward. The beds were filled and we began putting stretchers on the floor... All we could do was to stop the bleeding and get the patients as comfortable as possible... Men were dying on all sides - as many as 6 dead in the ward at once. They were dying faster than we could get them out... I could transfuse an occasional one but the majority had to take their chance without much treatment and go thru operation as best they could provided there was any possibility at all of their standing operation.

[The next day] The ward was still full. Many of the faces I remembered last night were no longer there and new faces had taken their place. Learned that we had taken in 1800 patients during the last 24 hours!

For his work, he received decorations from both the American and British governments and was discharged from the U.S. Army in 1919 after attaining the rank of Major. After World War I, he worked at the Rockefeller Institute doing research into pneumococcus and pneumonia, and in 1927 he became head of the Department of Medicine at the University of Chicago. He did no further work on transfusion after WW1, but his work during that period was instrumental in developing the use of citrate-stored blood for transfusion.

References to papers written by Oswald Robertson:

Robertson, O.H. (1918) A method of citrated blood transfusion. *British Medical Journal*, 1, 2991, 477-479. <https://www.bmj.com/content/1/2991/477>

Robertson, O.H. (1918) Transfusion with preserved red blood cells. *British Medical Journal*, 1, 2999, 691-694. <https://www.bmj.com/content/1/2999/691>