

This Week's Citation Classic

Collins G M, Bravo-Shugarman M & Terasaki P I. Kidney preservation for transportation. Initial perfusion and 30 hours' ice storage. *Lancet* 2:1219-22, 1969.
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This article described a method for kidney preservation by which the organ could be stored in ice for up to 30 hours with minimal damage. The main departure from previously used methods was in the composition of the flush solution, which was formulated to resemble the intracellular rather than the extracellular ionic content. [The SC® indicates that this paper has been cited over 340 times since 1969.]

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"My work in organ preservation began in 1968 in Paul Terasaki's laboratory at UCLA. The advantage conferred by histocompatibility matching for living donor kidney transplants was becoming evident, and it was believed that these benefits could be extended to cadaveric kidney transplantation if only there were a suitable method for preservation and transportation to a selected recipient. It was anticipated that it would frequently be necessary to send the preserved kidney to a recipient in another city by air transport. At that time the only preservation technique which had been shown to be capable of keeping kidneys in good condition for more than eight hours required a bulky perfusion machine and therefore did not seem practicable for transportation by air. The alternative method, used in the majority of transplant centers which did not possess a perfusion machine, was to immerse the organ in iced saline and flush out the vascular

compartment with an electrolyte solution of the type used for intravenous infusions. My reading on the subject led me to doubt whether such an approach conferred any benefit by comparison with ice immersion alone. In fact, on many occasions, the results seemed worse with the former method. The explanation for this appeared to lie in a report by Keeler et al.,¹ which described a rapid loss of intracellular ions, principally potassium and magnesium, when kidneys were perfused with cold electrolyte solutions of extra-cellular type. It seemed logical to try flushing the kidney with a solution formulated to resemble the intracellular, i.e., high in potassium and magnesium, rather than the extracellular ionic content. Compared with our previous findings, the results using an intracellular type flush solution were surprisingly good. Dog kidneys could be preserved in excellent condition for more than 24 hours by a single flush with a few milliliters of an intracellular type solution followed by immersion in ice. This appeared to be the technique we were looking for, and we were therefore more than a little surprised when the manuscript was turned down by *Lancet*. Fortunately, Grant Williams, a British transplant surgeon, interceded on our behalf with the editor who then agreed to publish the manuscript. Williams was particularly well placed to present our case since he was very familiar with the work, having preceded me in the same laboratory on a kidney preservation project.

"A scientific argument continues as to the precise mode of action of an 'intracellular' flush solution and which of cold storage or perfusion is the better method for clinical use. Perhaps this controversy is one of the reasons for the article's frequent citation. Nevertheless, our ability to preserve kidneys for a day or so has greatly altered the logistics of clinical kidney transplantation during the past ten years."

1. Keeler R, Swinney J, Taylor R M R & Uldall P R. The problem of renal preservation. *Brit. J. Urol.* 38:653-6, 1966.