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Special Article

Paul I. Terasaki, PhD, 1929–2016

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Paul Terasaki was a pioneer of transplantation and had a global following. His career, which spanned >50 years, included accomplishments and discoveries that revolutionized the field of transplantation and that advanced the care of transplant patients. Paul is survived by his wife Hisako, his brother, four children and six grandchildren as well as legions of close friends and colleagues around the world who will continue to build on his successes.

Abbreviations: UCLA, University of California Los Angeles; UNOS, United Network for Organ Sharing

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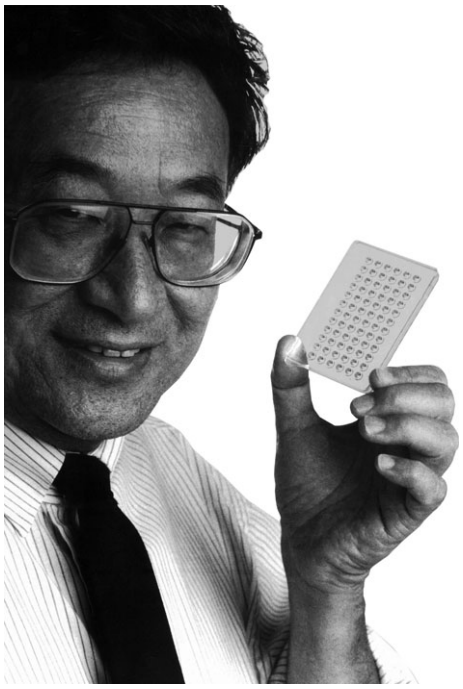
Paul Terasaki was a pioneer of transplantation and had a global following. His career, which spanned >50 years, included accomplishments and discoveries that revolutionized the field of transplantation and that advanced the care of transplant patients. He received the Medawar prize in 1996 and was honored by the American Society of Transplantation as an Innovator in Transplantation in 2013, two of his many cherished awards.

He created the microcytotoxicity test for HLA typing, which allowed the field of histocompatibility to advance on an international scale because it required only 1 μL of the rare human alloantisera used to identify HLA. In addition, he was a champion of HLA matching between kidney donors and recipients to improve transplant outcomes. Paul was as interested in the human alloantibodies that defined HLA types as he was in their targets and realized that those antibodies could damage a transplanted kidney. In the mid-1960s, he developed the lymphocyte crossmatch test, which dramatically reduced the incidence of catastrophic hyperacute rejections and is still used in more sensitive forms today. By reversing the microcytotoxicity test, he made it possible to identify sensitized patients awaiting a transplant and to estimate their chances of finding a crossmatch-compatible donor.

He established the University of California Los Angeles (UCLA) international cell exchange to ensure that HLA testing was uniform everywhere in the world and to provide typing challenges to laboratories so that they could work with unusual antigens or combinations of antigens that they might never see in their own practice. He trained >130 clinicians and scientists, many of whom were the first HLA laboratory directors in the United States and elsewhere.

Paul's contributions in other aspects of transplantation may be less widely recognized. He and Geoffrey Collins developed a simple cold storage solution for kidneys in the early 1970s and demonstrated that dog kidneys could be shipped in boxes from Los Angeles to Tel Aviv or to Sydney and could be transplanted and would work. That was followed by human kidney exchanges among 60 US transplant centers and, later, by shipping human kidneys that could not be placed locally to Japan, where they were successfully transplanted with up to 90 h of cold ischemia. Although the preservation solutions have changed, we still transport organs using cold storage today.



Dr. Paul I. Terasaki. Photo supplied by Ricardo Ordonez, Thermo Fisher Scientific.

He established the UCLA International Kidney Registry with 52 transplant centers around the world to collect data on the impact of HLA matching. In the first collaborative effort of its kind, he initiated a program to share kidneys among the 11 Los Angeles transplant centers for patients with better matches. He helped establish the first United Network for Organ Sharing (UNOS) kidney allocation system criteria for kidney allocation that favored well-matched transplants. UNOS maintained this experiment in national collaboration for 20 years, and >25 000 people received well-matched kidney transplants that survived better than others despite being shipped all over the country. The UCLA registry, together with registries for liver and heart transplants, was enlisted to help establish the National Scientific Registry of Transplant Recipients. The national data for kidneys were collected at UCLA from 1987 to 2000 and established a uniform base for data-driven policy making in transplantation.

In 1985, Paul published the first edition of *Clinical Kidney Transplants* in an effort to give information back to the 180 transplant centers that participated in the UCLA registry. The annual publication later included analyses of the UNOS organ-specific registries and provided a platform for many visiting fellows and trainees in the laboratory to analyze big data and to publish their findings.

In 1995, Paul reported that transplants between spouses (unrelated and poorly HLA-matched pairs) had much better results than anyone had expected. Within a year of that publication, there was a sharp rise in transplants not only between spouses but among friends, distant relatives, and even complete strangers, and this continues to be an important source of kidneys for transplant. The "virtual" crossmatch allowed kidney paired exchanges between patients and their crossmatch-incompatible living donors to expand to pairs at distant transplant centers. Although physicians were uniformly opposed to the idea of shipping living donor kidneys to facilitate exchanges, Paul's early work with the dog kidneys showed it would work, and once a few live donor kidneys had been shipped and transplanted successfully, everybody got on board.

Paul's most recent contribution to transplant has been the demonstration that HLA antibodies play a major role in late graft failures. He almost single-handedly convinced people to begin looking for antibodies after transplant, and he provided the tools to do that. It changed how the transplant community viewed long-term graft survival, from a nihilistic outlook on chronic failure to an opportunity to intervene and reduce the rate of late graft loss.

The histocompatibility reagents and tests that were used internationally were produced for many years in the UCLA Tissue Typing Laboratory. In 1984, he created a company, One Lambda, to continue production. The company continued to innovate and incorporate new technologies under his direction, and in the mid-1990s, One Lambda began testing a solid-phase system for identifying HLA antibodies using purified HLA and, later, individual HLAs produced by recombinant techniques. This test permitted very precise identification of HLA antibodies and enabled the creation of the "calculated" percent-reactive antibody, which provides a uniform estimate of sensitization and an estimate of the percentage of compatible donors for patients. It also allowed laboratories to provide a virtual crossmatch that streamlined organ allocation, and the number of sensitized patients who were transplanted doubled within a year of implementation. Following his retirement from UCLA in 1999, Paul established the Terasaki Foundation Laboratory to continue his important work on the role of antibodies that develop after transplantation.

Paul was always grateful for the opportunities that UCLA provided for him to accomplish his goals. He has given back generously, with donations to support the Center for Japanese Studies at UCLA; to construct a new life sciences building, which UCLA named the Paul I. Terasaki Life Sciences Building; and to establish multiple endowed chairs. He was awarded the prestigious UCLA Medal in 2014.

Paul is survived by his wife Hisako, his brother, four children and six grandchildren as well as legions of close friends and colleagues around the world who will continue to build on his successes.

Disclosure

The authors of this manuscript have no conflicts of interest to disclose as described by the *American Journal of Transplantation*.