



## **The Kidney Project: Abstract**

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End stage renal disease (ESRD), is a near-complete-to-total kidney failure. Presently, people living with ESRD (more than 650,000 people per year) have two treatment options: dialysis, which is costly, cumbersome, and confining; or transplant, which requires a long wait, a donor match, and a lifetime regimen of immunosuppressant medications. The mortality rate for dialysis patients is high; only 35% of patients are alive after five years. For those fortunate patients who receive kidney transplants, the outlook is much more positive; the five year survival rate for these recipients is almost 80%.

The Kidney Project is developing an implantable bioartificial kidney, the size of a coffee cup, which consists of two modules that work together to get rid of wastes. First, a silicon membrane hemofilter module processes incoming blood to create a watery ultrafiltrate that contains dissolved toxins as well as sugars and salts. Second, a bioreactor of silicon membrane-immunisolated kidney cells processes the ultrafiltrate and sends the sugars and salts back into the blood. In the process, water is also reabsorbed back into the body, concentrating the ultrafiltrate into “urine,” which will be directed to the bladder for excretion. This two-stage system will replicate much of the transport, homeostatic, metabolic, endocrinological, and immunoregulatory functions of a healthy kidney. The bioartificial kidney will process blood continuously for 24 hours per day, which will mitigate the inconveniences and morbidities associated with intermittent hemodialysis. No batteries or pumps will be needed; the body’s own blood pressure will force blood through the device as it does with a natural kidney.