

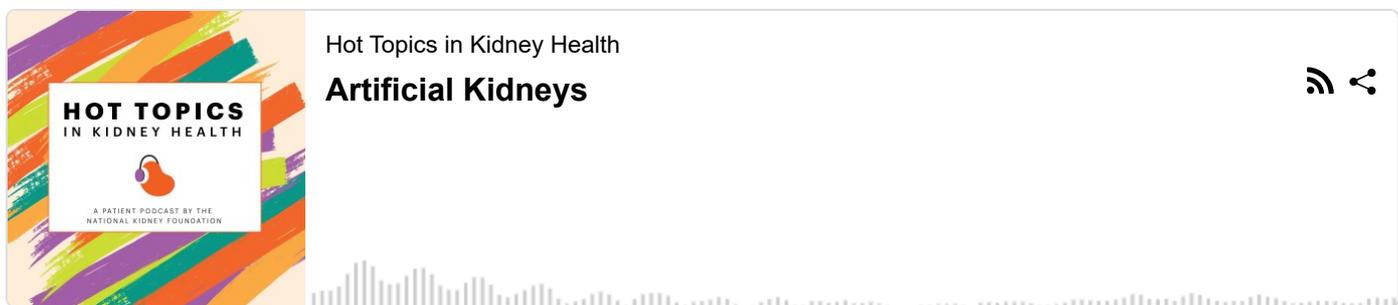
The Future of Artificial Kidneys

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As medicine advances so do new and innovative treatments for disease. Dr. Shuvo Roy, a professor and bioengineer with experience creating medical devices, is working on one such treatment that could revolutionize the future of kidney care: The Kidney Project's implantable artificial kidney.

What is an Artificial Kidney?



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An artificial kidney is a medical device that provides the same function as a kidney.

"Some may consider portable dialysis as an artificial kidney," Dr. Roy said. "The Kidney Project's artificial kidney is an implantable biomedical device that will work like a natural kidney and provide 24/7 treatment."

While the team's long-term goal is to replace all of the kidneys' functions, the early versions function similarly to kidneys in stage three or four kidney disease.

"We want to release this as soon as possible. Our survey found that patients value mobility and life off dialysis over the burden of taking pills and having a constrained diet," said Dr. Roy. "At stage three or four kidney disease, people can use medication, diet, and exercise to maintain their kidney disease and stay off dialysis."

Learn more about The Kidney Project's artificial kidney.

How Does the Artificial Kidney Work?

The artificial kidney is a device the size of a coffee cup. It consists of two components, the hemofilter and bioreactor. They work together to rid the body of wastes and maintain the body's fluid balance.

"The hemofilter processes incoming blood. It creates "ultrafiltrate", a solution containing dissolved toxins, sugars, and salts," Dr. Roy said. "The bioreactor contains kidney cells. It processes the ultrafiltrate and directs wastes and excess fluid to the bladder for removal."

The device is placed inside the body, similar to a kidney transplant. Then it is connected to blood vessels and the bladder. There are no external connections or power sources.

"In many medical devices, like pacemakers, the majority of the device is a battery," said Dr. Roy. "We developed a new cellular membrane filter that uses the patient's blood pressure to power the device. Nutrients from the blood feed the cellular component to ensure the cells survive and perform their function."

While the artificial kidney contains cells from an outside source, it should not alert the body's immune system and cause rejection.

"The pores are big enough to allow waste and excess fluids into the bioreactor but small enough to keep out immune cells," Dr. Roy said. "This allows the artificial to work while remaining isolated from the immune system."

While recipients won't require immunosuppressants, they will need Erythropoietin (EPO) injections. The artificial kidney cannot secrete EPO, an important hormone that stimulates red blood cell production.

Learn more about kidney transplantation with NKF's free online course.

When Will the Artificial Kidney be Ready?

There are no clinical trials for the artificial kidney, but animal testing has begun.

"We tested a small-scale prototype on lambs and pigs," said Dr. Roy. "The device worked as intended, giving us confidence that the implantable artificial kidney will work in humans once we have scaled up the device with enough capacity and conducted all the safety testing needed."

The Kidney Project hopes to begin clinical trials in four to five years, but that timeline could change.

"Technology development is dependent on the amount of financial resources available. I wrote this proposal in 2010 with hopes of having the first human testing by 2017," Dr. Roy said. "That timeline stretched and this one could too. It depends on when we have enough resources to finish the preclinical development."

Learn more about clinical trials.

Get Involved

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