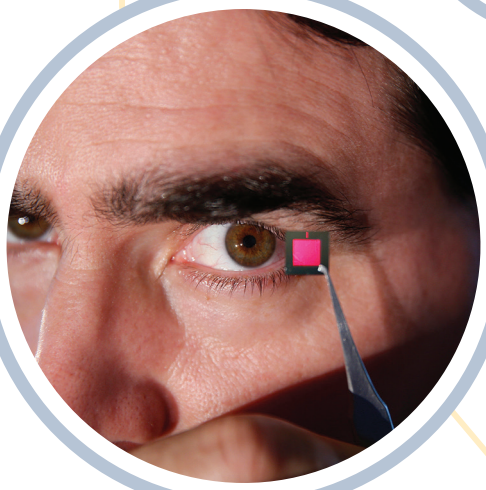
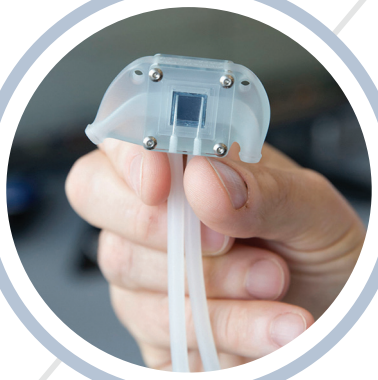
amazing things PODCAST

UMR UNITED FOR MEDICAL RESEARCH

GIVING KIDNEY PATIENTS THEIR QUALITY OF LIFE BACK





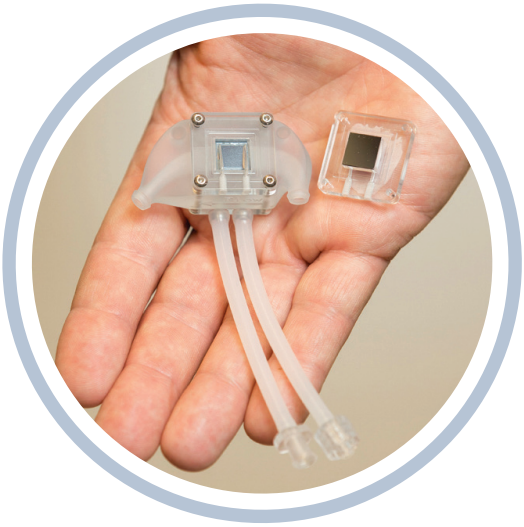
More than 460,000 Americans have end stage renal disease. While transplant of a human kidney is the best treatment for kidney failure, there simply aren't enough donor kidneys to go around, leaving the vast majority of these patients tied to dialysis machines for the rest of their lives. Every day 13 people die waiting for a kidney. Vanderbilt University Medical Center nephrologist and associate professor of medicine Dr. William H. Fissell IV and his colleague Dr. Shuvo Roy at the University of California, San Francisco have spent the better part of two decades working on a technology solution to this problem of supply and demand. And now, in 2016, they are closing in on what he calls the "Holy Grail" for people with kidney disease: An implantable artificial kidney.

Their bio-hybrid device, built from microchip filters and living kidney cells, would be powered by the patient's own heart and be about the size of a soda can, freeing kidney patients from dialysis and reducing the need for kidney transplants. While treatment options for those suffering from kidney disease haven't changed in decades, advances in two key areas of science — nanotechnology and regenerative medicine — have come together to make this 'bioartificial' kidney possible.

Inspired by nature, the artificial kidney has the same division of labor as a real kidney: filters and a bioreactor of living cells. In this case, the filters are made from silicon nanotechnology. They filter the blood and send the remaining fluid to the tubule. The bioreactor processes the filtered fluid by either adding or removing water and chemicals

CONTINUED ON BACK ➤

QUALITY OF LIFE
CONTINUED



according to the body's needs, and ultimately, producing urine. While growing the filters in the lab at this time is not feasible, kidney tubule cells do grow well in the lab. These cells can use the body's chemical energy to regulate fluid and electrolyte balance, and excrete wastes, eliminating the need for dialysate.

The costs to society of kidney disease are significant. Each year, the Centers for Medicare and Medicaid Services (CMS) spends around $35 billion to care for people with end-stage renal failure — more than the entire budget of the National Institutes of Health. Bringing down health care costs will be an enormous benefit of the bioartificial kidney, but not the only one. "If we can move people off thrice-weekly dialysis and let them get their quality of life back — that's the big offering. Patients can become who they want to be again. That's the gift of transplant and that's what we are trying to accomplish with our device," says Fissell. Pilot studies of the silicon filters could start in patients by the end of 2017.

Sustained funding from the NIH, and the National Institutes of Biomedical Imaging and Bioengineering (NIBIB) in particular, has been essential to the work of Fissell and Roy and development of their artificial kidney.

PHOTOS COURTESY OF VANDERBILT UNIVERSITY MEDICAL CENTER