Diabetes is a corrosive illness. The imbalance of blood sugar causes small changes in the body that slowly lead to blurry vision, skin rashes, and damaged nerves. In serious cases, diabetes wears away the path of blood to the kidneys, causing eventual organ failure. In fact, half of all kidney failures in the United States are caused by diabetes. For the majority of patients who end up on the waiting list for a kidney transplant, a diagnosis of kidney failure means a choice between dialysis and certain death.

Dialysis costs both time and money. Most patients must drive to a dialysis center three times per week to be hooked up to a machine for four hours per session. The annual costs for this treatment are about $80,000 per patient and rising. The total amount of private and public funds spent on the procedure will soon reach $50 billion per year. A single kidney transplant is equivalent in cost to about two-and-a-half years of dialysis, but it usually takes three years to find an available donor match.
The HSCI Kidney Group strategy to combat diabetic nephropathy incorporates short-term, medium-term and long-term plans to maximize the chances of preventing kidney failure in diabetics.

Our Vision

The Harvard Stem Cell Institute (HSCI) Kidney Group has short, medium, and long-term strategies to develop new therapies for diabetes-related kidney damage (diabetic nephropathy). This multi-pronged approach aims to capitalize on promising translational achievements in the near future, while pursuing potential drugs and the ultimate goal of creating an entirely artificial kidney using stem cells.

Short Term Plan

Mesenchymal stem cells are the body’s natural defense against kidney damage. Found in the bone marrow, these stem cells protect the kidneys from injury and accelerate healing. Harvard Stem Cell Institute scientists have identified protein candidates secreted from mesenchymal stem cells that may be administered independently to aid in kidney repair. In another approach, mesenchymal stem cells are being incorporated into miniature dialysis machines that expose the patient’s blood to these cells, allowing pro-repair proteins to be delivered directly to the kidneys.

Medium-Term Plan

Having identified the kidney cell types that are most susceptible to injury during diabetes, the HSCI Kidney Group now plans to target them with new drugs. In order to screen for potential drug targets, researchers must first identify genes that change in diabetic kidney cells, and then identify compounds that slow or stop the destructive gene expression. A drug for disease-related kidney damage has the potential to eliminate the need for dialysis.

Long-Term Plan

The project with the greatest potential impact on diabetes patients is HSCI’s large, multi-disciplinary effort to create an artificial kidney using stem cells and nanotechnology. Harvard Stem Cell Institute scientists plan to isolate kidney stem cells, mix them with soluble gels, and mold them into the architecture of a nephron. Scientists have already successfully created an artificial rat kidney that produces urine once transplanted into the animal, making artificial organ transplantation a highly possible reality for humans.