Blood-Cleansing System

EDGAR NANNE
PhD ’10 CHEMICAL ENGINEERING

To remain alive, nearly 500,000 Americans depend on thrice-weekly, in-clinic kidney dialysis. The treatment is costly ($23 billion a year—or about $46,000 per person), very demanding, and provides only a low quality of life. Some 80,000 Americans are on waiting lists for kidney transplants, with 4,000 dying each year before they get one. A steadily operating, ambulatory blood purification system would decrease patients’ burdens and increase quality of life for all of these patients.

Edgar Nanne, a PhD candidate working with Chemical Engineering Professor Edward Leonard, has been researching the properties of mass transfer in laminar flows of blood, creating the groundwork for the operation of the final dialysis apparatus.

“My contribution to the project, and to the patent, was the evaluation of how different substances of interest diffuse within blood flows as a function of flow properties, red blood cell concentration, and cell-membrane-molecule interactions,” says Nanne, a native of Guatemala.

The novel device uses the properties of transport phenomena combined with new manufacturing capabilities to exponentially increase the efficiency and efficacy in the removal of unwanted substances from the bloodstream. “Using the properties of dynamic similarity of fluid flow, we are able to flow blood and a protein solution with minimal mixing,” says Nanne.

The system, which is expected to be about 4 inches square and 1 ½ inches high, is designed to be worn by the patient at all times. It will remove water nearly continuously and remove other wastes whenever the patient is stationary.

The advantages to this new blood-cleansing system are many—improving patient quality of life; reducing the need for anticoagulant therapy and its side effects; eliminating the need for a surgical fistula that connects a patient’s artery and vein; and cutting treatment costs. It is expected that the first clinical trials on patients will be in 2011. “The challenges are big,” says Nanne, “but I believe that if this technology is to succeed, Professor Leonard should get a Nobel Prize for this work. It will mean a new life for dialysis patients.”