

# Vladimir K. Zworykin Award

## Willem J. Kolff

**For outstanding research contributions in the field of Medical and Biological Engineering**

Dr. Willem J. Kolff, Distinguished Professor of Surgery and Medicine, and Research Professor of Bioengineering, Emeritus, University of Utah, USA

officially retired on his 75th birthday in 1986, but still works on biomedical research projects.

resides in Newton Square, PA

Information:

Willem Kolff Foundation  
Kampen, The Netherlands  
[www.willemkolfffoundation.nl](http://www.willemkolfffoundation.nl)



Dr. Willem Kolff is considered the "father" of the field of artificial organs, which has led to the modern era of "substitutive medicine". Dr. Kolff's groundbreaking work on the artificial kidney changed kidney failure from a fatal to a treatable disease, prolonging the useful lives of millions of patients. Today, hemodialysis is offered in nearly every country in the world.

Willem Johan "Pim" Kolff was born on Valentine's Day (14<sup>th</sup> February) 1911 in Leiden, The Netherlands. After graduating from Leiden Medical School in 1938, he began postgraduate studies at the University of Groningen as an unpaid assistant under Professor Leo Polak Daniels, director of the University's medical department. Kolff witnesses one of his first patients, a farmer's son, die at the age of 22 of renal failure and hypertension. Kolff, a young father at the time cannot accept that people have to die merely because the body is unable to cleanse the blood sufficiently and starts his research on treating kidney failure, by building a machine that might be able to take over the kidney's function of removing toxins from the blood of patients with uremia.

When Germany attacks the Netherlands in May 1940, Kolff founds the first blood bank on the continent of Europe in The Hague. After the suicide of his Jewish mentor Professor Polak Daniels, Kolff decides to leave Groningen rather than to work under the Nazi successor appointed by the Germans. In 1941, he becomes the first internist at the municipal hospital in the small town of Kampen. Kolff grows into a crucial figure

in the local resistance. By simulating diseases on people who are in danger of being arrested by the German occupying forces, Kolff succeeds in keeping more than 800 'sick' resistance people and Jews out of the hands of the Nazis. During the darkest days in Nazi-occupied Holland Kolff manages to continue his research on an artificial kidney, working with wooden drums, cellophane tubes, and laundry tubs. He treats 16 patients with his rotating drum artificial kidney in 1943-1944. Fifteen of them die after no more than a few days on his machine and one survives with the kidney having no effect at all on the patient's recovery. A short time after the liberation of the Netherlands, the 17<sup>th</sup> patient, 67-year-old Sofia Maria Schafstadt, a Nazi sympathizer, is the first patient whose life is saved thanks to the rotating drum. With her recovery on September 11<sup>th</sup>, 1945 Kolff launched the field of artificial organs in biomedical engineering research.

Kolff receives a PhD in internal medicine *summa cum laude* at the University of Groningen in 1946 based on his thesis about the artificial kidney. In the first post-war years he ships free dialysis machines to researchers in England, Canada and the United States and expands his research to a heart-lung machine (1949). At the age of 39, he emigrates in 1950 with his wife and five young children to the United States, taking a position at the Cleveland Clinic Foundation in Ohio as head of the Department of Artificial Organs and professor of Clinical Investigatio. Here the first pump oxygenator for open heart surgery is used in a patient in 1955, and Kolff devotes himself to the development of the total artificial heart (1957) and the intra-aortic balloon pump (1961). He also improves the techniques of the drum kidney and develops the first disposable twin coil kidney (1955). Together with the Scribner shunt (1960) the invention of Kolff turned kidney failure from a fatal disease into a treatable one. Under Kolff, the Department of Artificial Organs at the Cleveland Clinic Foundation becomes the most important research center for biomedical engineering in the world at that time.

In 1967 Kolff moves from Cleveland to Salt Lake City to direct the Institute of Biomedical Engineering and the Division of Artificial Organs at the University of Utah. Kolff's team of surgeons, technicians and biomedical engineers develops many other types of successful artificial organs, such as artificial eyes, hearing, arms and the subcutaneous peritoneal access device. The permanent total artificial heart (TAH) becomes the most famous one. In 1982, with Kolff at the top of his game at age 71, the Jarvik-7 TAH is implanted in 61-year-old retired dentist Dr. Barney Clark. It is the first successful operation with a permanent TAH in the world. Clark survives for 112 days, after which he dies of pneumonia.

Under Kolff's leadership, the University of Utah has since developed one of the world's leading artificial organ research centers. It is estimated that since the first treatment

with the artificial kidney in 1943 in Kampen, Netherlands, more than 20 million lives were saved thanks to Dr. Kolff's inventions and the many people who continue his work.

Dr. Kolff has (co-) authored over 600 papers and articles, wrote numerous books, including *Artificial Organs*, and was founding and first president of the *American Society for Artificial Internal Organs* and co-founder of the *International Society for Artificial Organs*. In addition, he has received 123 awards (see insert) and 13 honorary doctorates. He was nominated for the Nobel Prize at least 4 times. Perhaps his most impressive award is the rank of Commander in the Order of Oranje-Nassau, a royal honor bestowed by Queen Juliana of the Netherlands in 1970. His was the first time the award had been presented to an individual living in the United States, and is the highest tribute for accomplishment in the field of science, which can be conferred by the government of the Netherlands upon a native of that country.

The main aim of Dr. Kolff's endeavors as a pioneer of artificial organs has been to restore impaired people to an enjoyable existence. To the question whether it is his intention that a human will ultimately be all composed of artificial organs that prolong his life he replies in a 2001 interview with the magazine *Wisselwerking (Interaction)* of the Dutch Organization of Kidney Patients, "This was always my philosophy: If you can give someone a happy life you should do it, if it cannot be a happy life you should not. When someone has an artificial heart and he has enough (of life) he should have a little key, then he can turn it off. But with a code, mind you, so his grandchildren cannot switch him off."

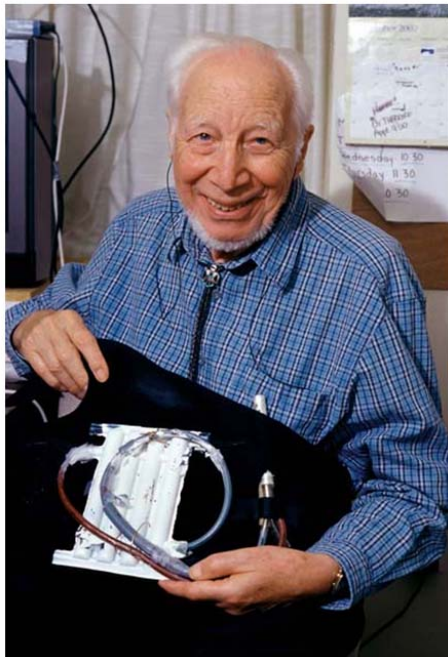


Photo 1



Photo 2



Photo 3