

A Ripple in Time:

50-year-old First Continues Saving Millions of Lives Today



William Heineman, center, accepts Clark's award from National Academy of Engineering (NAE) Chair Craig Barrett, left, and NAE President William A. Wulf, right, at the Washington, D.C., awards banquet in February 2005.

The world of engineering can be said to mirror nature's ripple effect: Like a stone that causes ripples in a pond, original ideas extend to cause ripples in the form of ideas and products created by others. Sometimes the products created from one "stone" end up saving lives.

One of Dr. Leland Clark, Jr.'s "stones," the Clark Oxygen Electrode, has generated many ripples that could one day result in a cure for diabetes.

The 2005 Russ Prize winner, who passed away Sept. 25, figured that being a researcher instead of a doctor would enable him to have a greater influence on human kind.

"For some reason or another, I'm always attracted to problems. If you solve this problem, you solve a lot of problems at once," Clark said when interviewed by Ohio University earlier this year. "I didn't want to just treat one patient at a time. If research is your aim, then you can treat ten thousand patients at once," he noted.

Considered the "father of biosensors," Clark invented the Clark Oxygen Electrode in 1954. The electrode quickly measures blood oxygen levels, a technology that today has enabled doctors to perform 750,000 open-heart surgeries each year and remains the standard in measuring dissolved oxygen in biomedical, environmental, and industrial applications. The technology is so important that oxygen monitoring is now a requirement for hospital accreditation. Quite a ripple.



The late Dr. Leland J. Clark, 2005 Russ Prize winner

ABOUT THE RUSS PRIZE

Established with a multimillion-dollar endowment in 1999 by the late Fritz J. Russ, B.S.E.E. '42, HON '75, and his wife, Dolores, the Fritz J. and Dolores H. Russ Prize is a \$500,000 biennial award that recognizes outstanding achievement in an engineering field of critical importance and significantly improves the human condition. Previous winners are:

- 2003: Willem J. Kolff, inventor of kidney dialysis
- 2001: Earl E. Bakken and Wilson Greatbatch, inventors of the heart pacemaker

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In 1964, Clark made another ripple. He expanded the capabilities of his oxygen electrode by making the sensors more intelligent. The biosensor he created from that idea now helps the approximately 140 million global sufferers of diabetes monitor their blood sugar.

Frank Schwartz, director of Ohio University College of Medicine's Diabetes Center, says the glucose biosensor has completely changed the way doctors treat patients with diabetes.

"The more information people with diabetes have, the more accurate they can be," he explained. "Keeping their blood sugar at the right level is crucial to enabling them to live healthier. The biosensor works by giving the patient a reading of their blood sugar every five minutes. We can now go from two or three blood sugar readings a day to one every five minutes for up to three days at a time."

The technology has also been the "stone" that will soon create a cure for diabetes.

"Very shortly, we'll have implantable pancreases based on the biosensor and glucose pump technology. The combination will create a close-looped system in the patient, just like artificial hearts," Schwartz said.

Engineers and researchers later discovered that the biosensor technology could be used in other ways.

"We're using enzymes in a biosensory way to detect viruses, bacteria, toxins, spores," said William Heineman, distinguished research professor at the University of Cincinnati. "Biosensors are used to monitor water supplies for homeland security. We are using the biosensor idea in ways that affect many, many people," he said.

With more than 80 patents to his name, there is no doubt that Clark, a graduate from the School of Medicine at the University of Rochester in New York, was an accomplished engineer worthy of the Russ Prize. The biosensor's ripple effect continues to help people across the world.

"I think science is the only thing that's ever going to save the world," he mused. "You have to have great tolerance for new ideas." 🌀