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In Intimate Detail

Auburn professor's high-powered microscope shows all

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AUBURN -- The death of a cancer cell under the microscope was sudden, dramatic and conclusive.

An experimental drug, marked by the tiniest of gold particles, was injected into a single cancerous cell from a rat. Immediately the gold bits swept the drug around the cell wall until it collapsed and died.

This was one of the first images produced by an advanced high-resolution microscopic system invented by an Auburn University scientist and being marketed now by a private Auburn-based company.

Vitaly Vodyanoy, a professor in the Department of Anatomy, Physiology and Pharmacology in Auburn's College of Veterinary Medicine, invented the device, patented as CytoViva.

Vodyanoy, a native of Russia, began working on the device in 1992 to support his research on other projects. He said he designed and built the first model because no other microscope could meet his research needs for observing fine cellular detail of specimens in real time.

"I needed the light to see it in real time," said Vodyanoy, who has a Ph.D. in biophysics from the Agrophysical Research Institute in Leningrad. "I couldn't find the technology I needed. All of a sudden, I came up with this idea."

"I actually built a prototype 12 years ago to use in my laboratory for other research projects," he said. "There were no commercial microscopes available that could provide enough optical resolution."

Vodyanoy surmised it would be too expensive to reinvent the microscope, so he developed a high-powered, high-resolution dark-field optical device that can be attached to any microscope.

"It extends light microscopy, offering a unique view of live cells and cell processes while they are occurring," Vodyanoy said.

Auburn sold the rights to manufacture the device to Aetos Technologies Inc., headed by chairman and CEO Thomas R. Lawrence. The university holds a 45 percent stake in Aetos Technologies, and Vodyanoy also shares in the sales.

CytoViva is manufactured by Optics 1 Inc. in Manchester, N.H., and marketed, so far, to researchers in the United States, Europe and Asia.

The first sale was to the American Society for Cell Biology.

The state-of-the-art precision research instrument is capable of observing living biological or physical specimens in fine detail and in real time. The resolution obtainable with Vodyanoy's microscope is about four to five times higher than the resolution possible using the best available optical microscopes.

Markets for the CytoViva include the medical fields, university research facilities, government, and commercial markets such as chemical, materials and pharmaceutical industries. The cost for the device can range from $10,000 to $50,000 depending on options such as high-end cameras.

The instrument "enables the observation of living cells in extremely fine detail and in real time, a capability that is not available among the best optical equipment on the market today," Lawrence said. It allows scientists to view both fluorescent and nonfluorescent samples simultaneously.

Another important advantage of the device is that samples viewed through the microscope need not be frozen, dehydrated, stained or manipulated in other ways.

The instrument, which is adaptable to most major research and clinical microscopes currently on the market, including Nikon, Olympus, Leica and Zeiss, could have important implications for researchers, from looking for cures for diseases to building stronger materials.

"The device allows a researcher to achieve a level of resolution far superior to the standard light microscopy," Lawrence said. "It helps the researcher recognize what he's looking at. But, more importantly, it allows him to track additives that he might put in the sample such as a new medicine going into the live sample. He can track it with the fluorescence and actually watch it work live."

Lawrence isn't predicting any major scientific breakthroughs anytime soon with the CytoViva.

"The way research works is it's a series of small victories over time. There's very rarely that gee whiz moment that changes the world," he said. "Basic research goes on in thousands of institutions across the world by thousands of investigators. I think our instrument is a tool in the ongoing search for knowledge. We will help people hit singles. We will be a workhorse, not a breakthrough instrument."

Charles Ludwig, president of Aetos Technologies' CytoViva division, said applications of the technology already have extended beyond traditional biological research to include nanotechnology and materials science-based researchers.

The CytoViva division has sales representatives based in Auburn, Manchester, N.H., and Philadelphia.

Byron Cheatham, director of sales, said the hottest area for sales of the CytoViva is in nanotechnology.

"One of the things done at the basic research level is to see if nanoparticles can be used to deliver cancer drugs, for example, directly to tumor cells and not affect the healthy cells," he said. "Tumor cells are more porous and certain sized nanoparticles will penetrate those cells but not the healthy cells."

"A significant amount of basic research is going on in that area. Our device is unique in that it allows the researcher to observe the nanoparticle and it allows them to observe them in real time with the live cell that they're trying to understand these reactions with."

Aetos Technologies was cited in September by R&D Magazine for developing one of the top 100 most technologically significant products for 2006.

Vodyanoy and representatives from Auburn University and Aetos Technologies will be honored by R&D Magazine on Oct. 16 in Chicago.