UA Engineering Professor Connects His Work in Medicine and Space

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Connections. University of Arizona physicist Wolfgang Fink, Ph.D., constantly makes them as he pursues research in medicine, space exploration and robotics.

The energetic associate professor embraces connections that enhance investigations into his varied interests. He enthusiastically pursues private- and public-sector connections that can turn his discoveries into marketable products.

The down-to-earth Fink, 43, is director of the UA Visual and Autonomous Exploration Systems Research Laboratory. He holds the Edward & Maria Keonjian Endowed Chair in Microelectronics.

He has joint appointments in the UA College of Engineering departments that deal with biomedical, electrical and computer, and systems and industrial engineering, as well as ophthalmology and vision science.

The spectacled German native is a visiting associate in physics at the California Institute of Technology and holds professorships in ophthalmology and neurological surgery at the University of Southern California.

His research passion lies in autonomous robotics for space exploration with an assist from work in artificial retinas for humans.

A Cross-Disciplinary Life

A theoretical physicist by training in Germany, Fink was attracted to focusing his thesis on something in medicine.

"I wanted to do something inter-disciplinary," he says. He investigated applying methods of theoretical physics to ophthalmology.

Early in his research career he continued to make connections among his work in medicine, unmanned space exploration and autonomous robots.

While devising optimization algorithms to design proteins, he discovered the method also worked in automating a robotic multi-jointed arm.

His current research into autonomous robots benefits from his work in medicine. He says the work in ophthalmology and robotics "fertilizes each other." An example is the artificial retina project.

Funded by the U.S. Department of Energy and the National Science Foundation, the project aimed to create an implant to provide some sight to people blinded by certain retinal diseases.

The project's public and private consortium developed an eye implant with a control chip and electrode array. It works with a camera attached to eyeglasses that the patient wears with an image processing device on a belt.

Fink developed the real-time image processor and created algorithms to adjust the vision for individual patients.

To help with those adjustments, Fink created the "Cyclops" rover as a blind patient surrogate. He programmed it to simulate a specific patient's vision using the artificial retina and then perform tasks such as navigating obstacles using that level of vision.

By watching how Cyclops responded, researchers could refine the image processing on it, then provide the patient with an image processing software update. It eliminated the need to spend hours with the patient.

Fink applied his findings with Cyclops to autonomous rovers he's developing to explore other planets.

As part of a multi-tiered exploration system, the rover could respond to and research its environment. Hours would be saved by eliminating the time it takes for humans to transmit instructions to extraterrestrial robotic explorers.

Taking Science to Market

While Fink appreciates the value of basic research, he embraces making the connection between the lab and the market.

"It's rewarding to see work that actually gets applied for the benefit to the patient, to the real world," he says.

He currently holds one European and 11 U.S. patents. Some provide equipment and methods for medical examinations and diagnostics. Others describe a multiple-craft autonomous system that allows for exploration in hazardous or inaccessible areas.

The artificial retina project won Fink and the consortium the prestigious *R&D Magazine's* 2009 R&D 100 award and the R&D 100 Editors' Choice award. Recently he became a fellow of the American Institute of Medical and Biological Engineering.

His work on space exploration has won several NASA Techbrief awards, NASA patent awards and a NASA Board Award.

Fink thrives on the variety of his work, from teaching and researching to programming, building prototypes and publishing. Developing and patenting products for markets cap his efforts, he says.

"When you work with companies to actually get your patent licensed, that's the icing on the cake."

See a video about Fink's planetary rovers and the concept of the multi-tiered exploration system.

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Wolfgang Fink, Ph.D., created the "
surrogate. But he applied that know
exploration system in which rovers
research their surroundings. Photo
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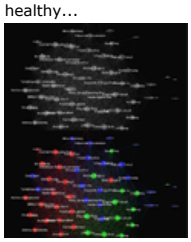

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