



# RESEARCH NEWS

Comments, submissions  
and event listings to:  
stefaniu@ms.umanitoba.ca  
Phone: (204) 474-9020  
Fax: (204) 261-3473

## Researcher sheds light on grain quality

By Frank Nolan, Research Promotion Officer

When you visit Jitendra Paliwal's lab, you soon learn there's more to grain quality than meets the eye. Paliwal, biosystems engineering, is leading an innovative project that combines machine vision technology with infrared spectroscopy to provide an accurate picture of how good a kernel really is, right down to its chemical composition.

"Traditionally, visible light and the human eye have been the best tools for determining grain quality," Paliwal said. "Inspectors decide whether grain is graded as high quality, feed quality, and so on. This can be quite subjective, because what looks good to you may not look so good to me."

To make inspections more accurate and efficient, Paliwal is working on a system that uses machine vision—a camera connected to a computer—to scan grain samples. The computer can be "trained" to recognize the different visible characteristics that determine grain quality.

"We're also using infrared spectroscopy, which is a great tool for characterizing chemical compounds in biological systems," he said. "If there are particular peaks in the spectrum, we can say that one peak represents water, one represents protein, and so on, and this allows us to describe the specific

chemical make-up of the sample."

Paliwal's lab is the only one in Canada combining machine vision and infrared technology to classify grain. The system can be trained to not only recognize visible characteristics and determine chemical composition, but also to detect damaged grain and foreign material in the sample. One of the project's biggest challenges, though, is training the computer to work with samples that contain multiple grain kernels.

"If you show the computer several grain kernels at the same time and they are touching each other, it often can't recognize them as separate objects," he said. "Finding a way to separate the grains so that the computer can make sense of it is a major part of my research."

Paliwal's work recently caught the attention of Perten Instruments, a Swedish spectroscope manufacturer trying to overcome the same hurdle in its own research. Paliwal's group has received a strategic projects grant of \$318,500 from the Natural Sciences and Engineering Research Council of Canada (NSERC) to collaborate with Perten on a three-year project to refine the combined machine vision/infrared spectroscopy technology.

Paliwal is also applying his expertise

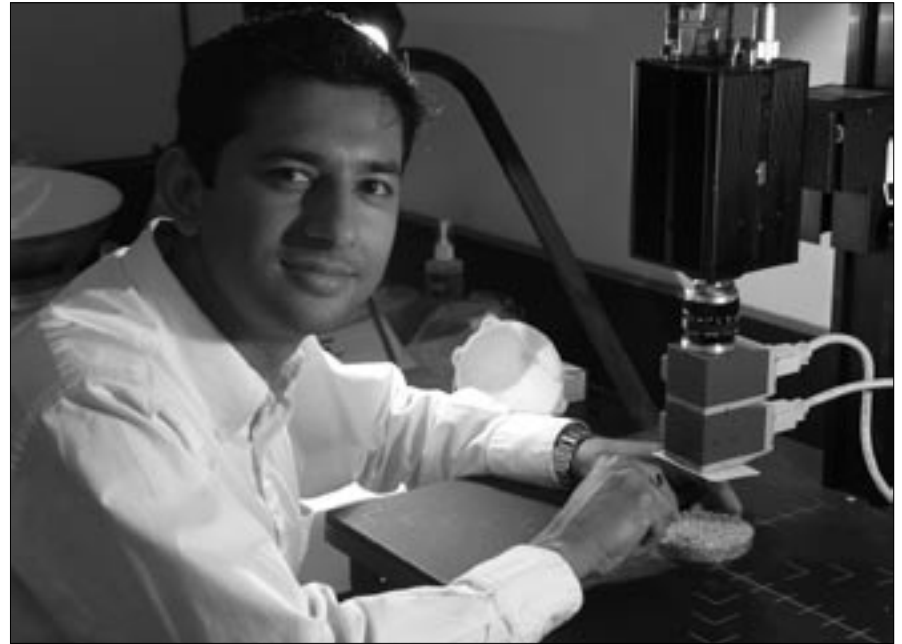


Photo by Frank Nolan

**Jitendra Paliwal, biosystems engineering.**

with advanced optical methods to the problem of detecting *Fusarium* fungi in wheat.

"*Fusarium* infested grain is not fit for human consumption, and if it is bad enough, the grain can't even be used for feed," he said. "It is very rare for 100 per cent of the grain to be affected, but right now there is no efficient way to separate the bad grains from the healthy ones, so we end up destroying the entire lot, costing producers millions

of dollars each year."

Working with a Manitoba-based company, Spectrum Scientific, Paliwal is developing an optical system that will detect and separate *Fusarium*-infested grains. He said such technology will be particularly beneficial to Manitoba's rapidly-expanding ethanol industry, which currently uses expensive, high-quality grain to avoid problems with *Fusarium*.

## Hawthorne elected to Russian Academy of Sciences

By Frank Nolan, Research Promotion Officer

University of Manitoba mineralogist Frank Hawthorne has been elected as a Foreign Member of the Russian Academy of Sciences in recognition of his outstanding research contributions. He is only the fourth Canadian scientist

to receive this honour, succeeding John Polanyi (University of Toronto), Michael Smith (University of British Columbia) and William Fyfe (University of Western Ontario).

Hawthorne, Distinguished Professor of geological sciences, holds a Canada Research Chair in Crystallography and Mineralogy, and is internationally recognized as a leader in his field. In 1995, a new mineral was named in his honour, and in February 2006, he was named as an Officer of the Order of Canada.

"The results of Dr. Hawthorne's theoretical and experimental research are very highly regarded," said Professor Vadim Kazansky, a member of the Moscow-based Institute of Geology of Ore Deposits, Petrography, Mineralogy and Geochemistry (IGEM), part of the Russian Academy of Sciences. "He is well-known for his studies on crystal structure and crystal chemistry of complex minerals, but his research has also contributed to and advanced a number of other trends in modern mineralogy."

Hawthorne is currently working with Russian scientists examining rocks recovered from the Kola Superdeep Borehole in northwestern Russia. The world's deepest drill-hole, it extends down 12.2 kilometres, and provides an unprecedented opportunity to study continuous, unaltered sections of the Earth's crust.

"This project really started when Professor Elena Sokolova (geological sciences) arrived in Manitoba in 2001 with preliminary Kola samples," Hawthorne said. "Later that year, Academician Nikolai Laverov, Director of IGEM, and I signed a collaborative research agreement between the University and IGEM, and I was invited to speak at a special scientific session of the Russian Academy of Sciences."

The agreement was for a three-year collaboration with IGEM scientists, including Professor Kazansky and Professor Konstantin Lobanov. The project also included Yulia Uvarova, a student from Moscow State University, who came to the University of

Manitoba to begin graduate studies focused on the Kola rocks.

"It's always inspiring when you are able to work with colleagues in other countries," Hawthorne said. "One of the great perks of this job is that you are able to meet and become friends with smart people from all over the world."

The collaborative research agreement was renewed for three more years in 2004, and Hawthorne was invited to speak at a special scientific session of IGEM on the progress of the collaboration to date. The Scientific Council of IGEM subsequently proposed Hawthorne as a Foreign Member of the Russian Academy of Sciences, and he was officially elected in May 2006.

"When I received word that I had been elected as a Foreign Member, I was very excited," Hawthorne said. "It truly is a great honour, and it's very fulfilling, because you feel that you've jumped out of your field of study into something larger."



Submitted photo

**Distinguished Professor Frank Hawthorne, Canada Research Chair in Crystallography and Mineralogy.**

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