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Research Studies Using Nanoscale Imaging Tools Will Help Plants And Humans

Nanoscale Tools Allow Researchers To Image Chromosome Structures In 3D

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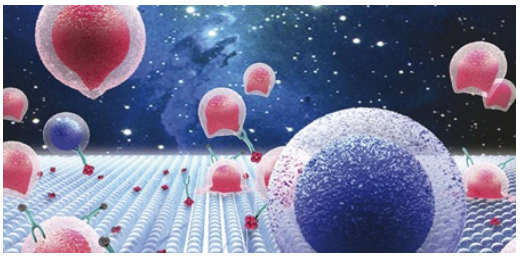

Three-dimensional Imaging At The Nanoscale

Study Suggests Nanoscale Tools Will Help Detect Disease In Humans And Plants

Your doctor pinpoints faulty genes that might increase your risk of cancer. Standing in a field, a farmer uses a handheld tool to scan crops for diseases.

Such novel ways to predict and detect human and crop diseases more rapidly and accurately may one day result from new nanoscale methods for looking at genetic material tested by University of Guelph researchers.

So says engineering professor Suresh Neethirajan, who has co-authored a study published in Nanoscale Research Letters with Guelph student Zhong Yangquanwei and Chithra Karunakaran, a researcher at the Canadian Light Source (CLS) synchrotron facility in Saskatoon.

The team used nanoscale imaging techniques -- notably scanning transmission X-ray microscopy and atomic force microscopy -- to study chromosomes of quinoa, a minor grain crop high in protein.

Conventional imaging tools fail to yield clear pictures of chromosomal structures on the nanoscale, critical to understanding gene function and assessing the appearance and makeup of genetic material, said Neethirajan.

He said nanoscale tools allow researchers to image chromosome structures in 3D and map amounts and kinds of proteins and nucleic acids that make up DNA.

The team's work might help researchers build libraries of DNA biomarkers to pinpoint defective genes involved in human and plant diseases. Crop scientists might also use these tools to zero in on genes involved in disease resistance or drought tolerance.

Right Photo: Professor Suresh Neethirajan

"There's a huge demand for novel tools," he said. "The imaging work we are doing is the best way to understand and investigate chromosomes in their natural state."

Neethirajan has used nanoscale imaging tools to look at the evolutionary history of two buckwheat species -- useful information for breeders looking to improve crops.

Working with plant agriculture professor Istvan Rajcan, he plans to apply these imaging tools to soybeans, including looking for genes involved in resistance to cyst nematodes. These pests cost millions of dollars' worth of damage each year to soybean crops in Ontario.

"The potential for developing precise molecular cytogenetic mapping using nanoscale technology is huge. It is possible to solve key challenges in plant breeding as well as in the biomedical field."

Imaging for this study took place in Neethirajan's bio-nano laboratory at Guelph and at the CLS.

ZEISS three-dimensional imaging at the nanoscale

ZEISS is introducing a new X-ray microscopy (XRM) solution that increases throughput for three-dimensional imaging at the nanoscale by up to 10 times. Using a series of technical innovations to achieve better contrast, and in turn faster acquisition, the new ZEISS Xradia 810 Ultra revolutionizes the X-ray imaging model in scientific and industrial research labs worldwide.