

Breaking the mucus barrier unveils cancer cell secrets

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Measuring the mechanical strength of cancer cell mucus layers provides clues about better ways to treat cancer, and also suggests why some cancer cells are more resistant to drugs than others, according to Kai-tak Wan, associate professor of engineering at Northeastern University, Boston, Mass.

According to Wan, healthy tissues naturally secrete mucus to protect against infection. Cancer cells, however, produce far more mucus than healthy cells.

Mucus consists of protein "stalks" attached to sugar sidechains, or "branches." This tangled brush forms a physical barrier. When over-expressed, it can prevent drugs from reaching the cancer cells beneath. Over-expressed mucus also makes it easier for cancer cells to break away from surrounding cells and move through the body, or metastasize.

Wan's research partner, Robert B. Campbell, an associate professor of pharmaceutical sciences at Massachusetts College of Pharmacy and Health Sciences, Worcester, Mass., is investigating the use of chemical agents that limit the formation of this tangled mucus barrier so medicines can get through.

To determine how well those agents work, Wan used the nanoscale tip of an [atomic force microscope](#) to push against the mucus barrier. The less resistance it encountered, the less tangled the barrier.

Wan found that suppressing the formation of mucus sidechains significantly reduced the energy needed to pierce the mucus barrier in lung, breast, colorectal, pancreatic, and wild type (natural) ovarian cancer cells.

Yet the treatment registered barely any change in multi-drug resistant ovarian [cancer cells](#). No one understands how those cells resist drugs that ordinarily kill wild type [ovarian cancer](#).

Wan's research points to an important difference. The mucus layer formed by the two types of cells reacts differently to the same chemical treatment.

"How this phenomenon is related to biochemistry is unknown at this stage, but it tells us what we should be looking at in future research," Wan said about his and Campbell's conclusions.

More information: The article, "Glycoprotein mucin molecular brush on cancer cell surface acting as mechanical barrier against drug delivery" by Xin Wang, Aalok A. Shah, Robert B. Campbell, and Kai-tak Wan appears in the journal *Applied Physics Letters*.
link.aip.org/link/applab/v97/i26/p263703/s1

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