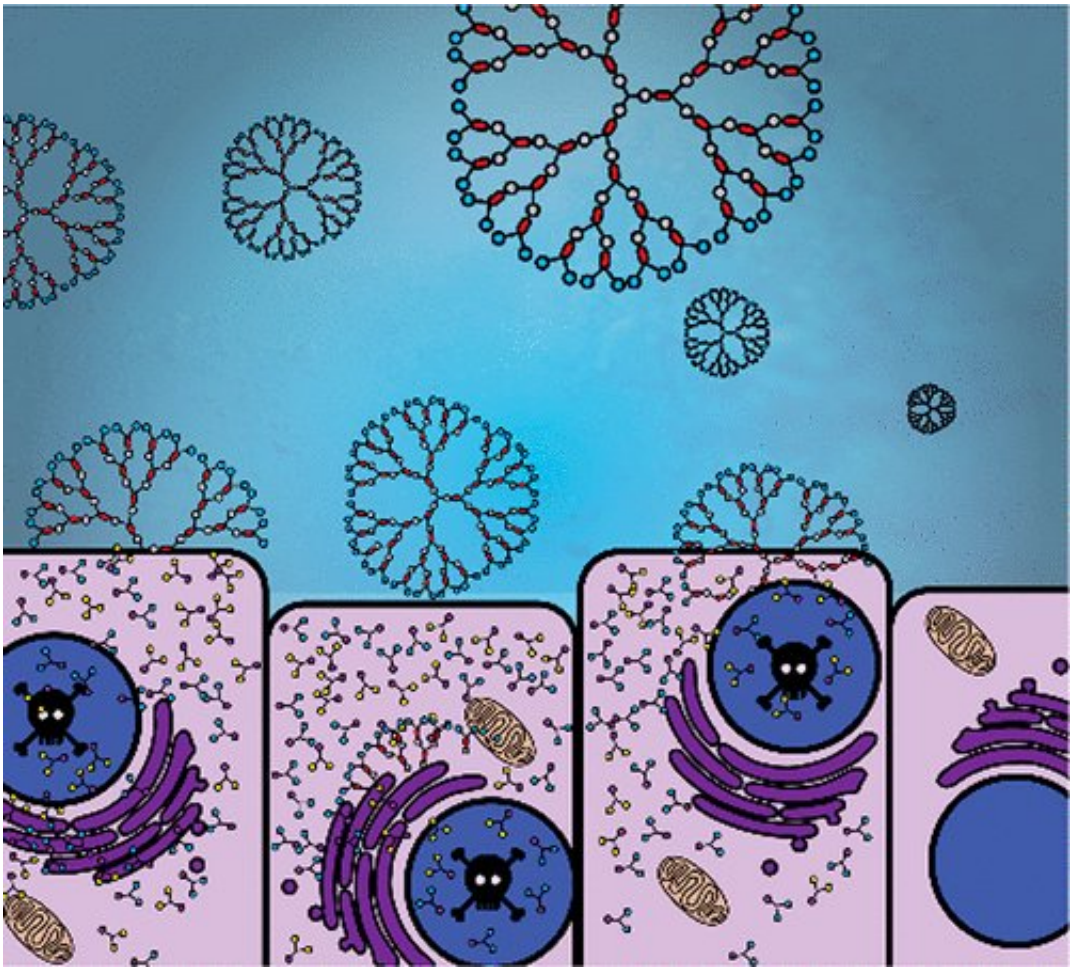
Precision nanomaterials may pave new way to selectively kill cancer cells, study shows

December 13 2017



Dendrimers loaded with organic sulfure compounds (OSC) accumulate in cancer cells, where they are broken down and release reactive oxygen radicals (ROS). The elevation of ROS levels eventually spells death for the cancer cell. Credit: KTH The Royal Institute of Technology

Researchers in Sweden have succeeded in taking the next step toward using man-made nanoscale compounds in the fight against cancer. A recent proof-of-concept study showed that dendrimers, which were first introduced in the 1980s, may be used to introduce compounds that essentially trick cancer cells into performing self-destructive tasks.

Dendrimers, or cascade molecules, are organically synthesized large molecules that match nature's peptides and proteins with respect to size and structure. Researchers from KTH Royal Institute of Technology took advantage of these qualities – and cancer cells' appetite for adsorbing large molecules – by loading the material with an organic sulfur compound (OSC) which is also a key ingredient in amino acids, peptides and proteins.

Applying these to cultured human cancer cells sets in motion a process that distracts cancer cells from their normal task of multiplying, and instead go to work on picking apart disulfide bonds in the dendrimers, says Michael Malkoch, a professor of fiber and polymer technology at KTH.

Malkoch says that this activity releases an increased concentration of reactive oxygen radicals (ROS), which eventually induces cell death. Unlike treatments like chemotherapy, the effect is selective toward cancer cells, leaving the healthy ones unaffected since healthy cells have a higher tolerance for ROS.

The nanomaterial is finally broken down by the body, he says.

The article was published in *Journal of the American Chemical Society*, and is co-authored by Malkoch, KTH doctoral student Oliver Andrén and Aristi P. Fernandes of Karolinska Institutet.

Their results show that the platform is worth continued research with

clinical tests in which dendrimers are preprogrammed with large and specific numbers of organic disulfide bonds, Malkoch says.

"We've just scratched the surface for what you can do with dendrimers. We have previously tested using similar materials as a part of a leg patch – a type of adhesive that in some cases enables treatment of bone fractures without screws and plates," he says. "You can imagine future applications where the material is used to coat implants around cancer tumors and thereby enable therapy treatment at a localized level."

More information: Oliver C. J. Andrén et al. Heterogeneous Rupturing Dendrimers, *Journal of the American Chemical Society* (2017). DOI: 10.1021/jacs.7b10377

Provided by KTH Royal Institute of Technology