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NTU Singapore scientists devise 'Trojan horse' approach to kill cancer cells without using drugs

Cancer cells are killed in lab experiments and tumour growth reduced in mice, using a new approach that turns a nanoparticle into a 'Trojan horse' that causes cancer cells to self-destruct, a research team at the Nanyang Technological University, Singapore (NTU Singapore) has found.

The researchers created their 'Trojan horse' nanoparticle by coating it with a specific amino acid – L-phenylalanine – that cancer cells rely with other similar amino acids, to survive and grow. L-phenylalanine is known as an 'essential as it cannot be made by the body and must be absorbed from food, typically from meat and products.

Studies by other research teams have shown that cancer tumour growth can be slowed or pre 'starving' cancer cells of amino acids. Scientists believe that depriving cancer cells of amino ac example through fasting or through special diets lacking in protein, may be viable ways to tre

However, such strict dietary regimes would not be suitable for all patients, including those at malnutrition or those with cachexia – a condition arising from chronic illness that causes extre and muscle loss. Furthermore, compliance with the regimes would be very challenging for ma

Seeking to exploit the amino acid dependency of cancer cells but avoid the challenges of stri regimes, the NTU researchers devised a novel alternative approach.

They took a silica nanoparticle designated as 'Generally Recognized As Safe' by the US Food a Administration and coated it with L-phenylalanine, and found that in lab tests with mice it kill cells effectively and very specifically, by causing them to self-destruct.

The anti-cancer therapeutic nanoparticle is ultrasmall, with a diameter of 30 nanometres, or approximately 30,000 times smaller than a strand of human hair, and is named "Nanoscopic phenylalanine Porous Amino Acid Mimic", or Nano-pPAAM,

Their findings, published recently in the scientific journal Small, may hold promise for future c nanotherapies, said the research team.

Assistant Professor Dalton Tay from the School of Materials Science and Engineering, lead aut study, said: "Against conventional wisdom, our approach involved using the nanomaterial as instead as a drug-carrier. Here, the cancer-selective and killing properties of Nano-pPAAM ar and do not need to be 'activated' by any external stimuli. The amino acid L-phenylalanine act horse' – a cloak to mask the nanotherapeutic on the inside."

"By removing the drug component, we have effectively simplified the nanomedicine formulat overcome the numerous technological hurdles that are hindering the bench-to-bedside trans drug-based nanomedicine."

Intrinsic anti-cancer therapeutic properties of Nano-pPAAM

As a proof of concept, the scientists tested the efficacy of Nano-pPAAM in the lab and in mic that the nanoparticle killed about 80 per cent of breast, skin, and gastric cancer cells, which is

to comparable to conventional chemotherapeutic drugs like Cisplatin. Tumour growth in mice with human tr breast cancer cells was also significantly reduced compared to control models.

Further investigations showed that the amino acid coating of Nano-pPAAM helped the nanoparticle enter the cancer cells through the amino acid transporter cell LAT1. Once inside the cancer cell, Nano-pPAAM stimulates excessive reactive oxygen species (ROS) production – a type of reactive mo body – causing cancer cells to self-destruct while remaining harmless to the healthy cells.

Co-author Associate Professor Tan Nguan Soon from NTU's Lee Kong Chian School of Medicine said, "With current chemotherapy drug treatment, a common issue faced is that recurrent cancer become resistant to the drug. Our strategy does not involve the use of any pharmacological drugs but the nanoparticles' unique properties to release catastrophic level of reactive oxygen species (cancer cells."

Providing an independent view, Associate Professor Tan Ern Yu, a breast cancer specialist at Ta Hospital said, "This novel approach could hold much promise for cancer cells that have failed to conventional treatment like chemotherapy. Such cancers often have evolved mechanisms o to the drugs currently in use, rendering them ineffective. However, the cancer cells could pote be susceptible to the 'Trojan horse' approach since it acts through a completely different mec one that the cells will not have adapted to."

The scientists are now looking to further refine the design and chemistry of the Nano-pPAAM more precise in targeting specific cancer types and achieve higher therapeutic efficacy.

This includes combining their method with other therapies such as immunotherapy which use immune system to fight cancer.

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