Nanoparticle boosted T-cells take on cancer

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(PhysOrg.com) -- According to a study in *Nature*, Darrell Irvine from the Massachusetts Institute of Technology and his team members have found a way to boost the natural immune system when it comes to fighting cancer by arming them with interleukin-filled nanoparticles.

T-cells are a group of white blood cells that works with the body's immune system. When cancerous cells are found within the body, T-cells swarm around to try and destroy the cancer. However, many tumors will emit a chemical which works to weaken the T-cells, allowing the cancer to continue to grow.

Irvine's team discovered that they were able to attach 100 nanoparticle capsules to a T-cell without affecting its function. The team then filled these capsules with interleukins. Interleukins are naturally made in the immune system and work as system regulators by keeping the T-cells fighting. By adding the additional interleukins, they increase the ability for the T-cells to push forward and attack the cancerous cells.

The team then injected these boosted T-cells into mice who were infected with bone and lung cancer. The T-cells immediately swarmed the cancerous cells and were able to stay functional for much longer than the traditional T-cells. In addition, mice treated with regular T-cells died from tumors within a month, while those treated with the boosted cells were had improving health.

Because these T-cells are being modified by the nanoparticles, there is no need for them to be genetically modified which is complex and

costly. This process also has the potential to speed up clinical trials.

More information: Therapeutic cell engineering with surface-conjugated synthetic nanoparticles, *Nature Medicine* 16, 1035–1041 (2010) doi:10.1038/nm.2198

Abstract

A major limitation of cell therapies is the rapid decline in viability and function of the transplanted cells. Here we describe a strategy to enhance cell therapy via the conjugation of adjuvant drug–loaded nanoparticles to the surfaces of therapeutic cells. With this method of providing sustained pseudoautocrine stimulation to donor cells, we elicited marked enhancements in tumor elimination in a model of adoptive T cell therapy for cancer. We also increased the in vivo repopulation rate of hematopoietic stem cell grafts with very low doses of adjuvant drugs that were ineffective when given systemically. This approach is a simple and generalizable strategy to augment cytoreagents while minimizing the systemic side effects of adjuvant drugs. In addition, these results suggest therapeutic cells are promising vectors for actively targeted drug delivery.

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