Ultrasensitive Anticancer T Cell Isolation From High Bystander Noise via Immunobiology-Inspired Microfluidics

Lo, Sean (School: Taipei Municipal Chien Kuo High School)

Imagine your immune system is an army of tiny soldiers called T cells, and their job is to hunt down and destroy cancer. This is called T cell therapy, and it is a very hopeful way to treat cancer. However, it is really hard for scientists to recruit a force to tackle cancer because your body has millions of different T cells, and only a few of them are actually good at catching cancer. To solve this, we created a tiny "lab-on-a-chip" that acts like a specialized obstacle course for these cells. Inside this chip, I use a special gelated cell to create a surface that mimics the way a real antigen presenting cell looks and feels. When T cells are added into the chip, they try to grab onto this surface with a "molecular handshake." To make sure we only keep the best ones, we create a tiny river, which is laminar flow inside the chip. The liquid flows past the cells, pushing on them like wind. If a T cell does not have a strong antigen specific grip, or if it is grabbing the wrong target, it simply gets washed away by the current. By carefully adjusting the speed of washing, we can choose exactly which cells stay and which ones go. This helps us find the elite T cells—the ones that are strong enough to kill cancer. This novel system makes it much easier for scientists to precisely pick the right T cells for patients, offering a promising solution to one of the biggest challenges in medicine today.

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