



What is CAR-T cell therapy?

Chimeric antigen receptor (CAR) T-cell therapy is a form of immunotherapy in which T cells, a specific type of immune cell, are genetically modified in a lab with “instructions” on what the patient’s cancer looks like. These modified T cells are then reintroduced into the patient in a clinic, where they attempt to find and kill cancer cells.

How do you make the therapy?

CAR T-cells are made by separating an individual's T-cells from their blood in the clinic. These T cells are then transported to a clinical lab where they undergo modification by introducing a gene for the specific chimeric antigen receptor (CAR). As a result, the T-cells express the chimeric antigen receptor on their surface, making those T-cells into CAR T-cells. These CAR-T cells are then expanded in the lab to increase their numbers and ultimately reintroduced into the patient's bloodstream, where they attempt to find and kill cancer cells.

What are the benefits of CAR T-cell therapy?

CAR T-cells therapies are one of the latest tools in the cancer therapy toolkit, and they hold many benefits. Unlike traditional cancer therapies, CAR T-cell therapies are “living medicines” that actively circulate throughout the body, sometimes for years, searching out and killing cancer cells. Their long lifespan allows them to survey the body and kill cancer at the primary and distant metastatic sites. CAR T-cells can grow in concert with the patient’s disease, meaning that only a single infusion is generally required, vastly improving the patient’s experience, and reducing costs to the healthcare system.

What are the side-effects?

Despite the many benefits of CAR T-cell therapies, mild to severe side effects are possible. The most common side effect is cytokine release syndrome, which can cause flu-like symptoms such as fever, low-energy, or body aches. Neurotoxicity is also a potential complication, leading to symptoms such as headaches, confusion, seizures, or a loss of balance. T-cell therapy is a specialized treatment available in centers who are familiar with this treatment and who can manage some of the side effects that can happen with the treatment.

What cancers is this therapy being used on?

CAR T-cell therapy is already standard of care for some blood cancers, including certain forms of leukemia and lymphoma. In 2018, CAR T-cell therapy first received approval in Canada for use against two deadly blood cancers: B cell leukemia and B cell lymphoma. That treatment is the first genetically engineered cell therapy to enter the healthcare marketplace. Since then, Health Canada has approved a total of six CAR T-cell products for the treatment of blood cancers, with the most recent in 2023 for multiple myeloma, another

deadly blood cancer. The Riddell Centre is one of the first centres in Canada to use precision cellular therapy on treatment-resistant solid tumours.

Can anyone ask for CAR T-cell therapy?

No, eligibility for CAR T-cell therapy depends on a number of factors, including the type of cancer, its stage, the overall health of the patient, and previous treatments received by that patient. The decision to use CAR T-cell therapies is made by a team of oncologists and healthcare professionals with the patient. The therapy is designed to treat patients who have failed other lines of treatment and in the hopes of putting patients in remission.

Did UCalgary invent CAR-T cell therapy?

No. The concept of CAR T-cell therapy was developed thanks to the collaborative efforts of many researchers over decades. Notably, Dr. Carl June and his team at the University of Pennsylvania played a crucial role in advancing CAR T-cell therapy and conducting early clinical trials that demonstrated its effectiveness, leading to the eventual approval of CAR T-cell therapies for certain blood cancers

What piece did UCalgary researchers invent/discover?

In 2015, a local patient with alveolar soft part sarcoma underwent surgery to remove their tumor and generously contributed tissue samples to a local tumor and tissue bank. Alveolar soft part sarcoma is a rare cancer affecting children and adolescents, originating from soft connective tissues like fat, muscles, and nerves. A UCalgary team's analysis of these samples identified a single molecular rearrangement generating a unique protein on the surface of the patient's cancer cells. The team invented a novel CAR T-cell therapy to target that specific protein. That CAR T-cell therapy, called GCAR1, has been tested in animal models mimicking the patient's disease, and ultimately finds and kills sarcoma cells.

What is the future for CAR-T cell therapy at UCalgary?

The future of CAR T-cell therapy at the University of Calgary is bright. Thanks to funds raised through the OWN.Cancer Campaign and funding provided by donors; the Riddell Centre for Cancer Immunotherapy has opened. The mission of the Centre is to reduce the burden of cancer in children, adolescents and adults and improve patient outcomes and survival through the rapid development and implementation of safe and effective immunotherapies. The Centre will cultivate advanced translational research and the development of novel immunotherapies for cancer and facilitate their rapid evaluation in human clinical trials.