**Mechanism**

T-cells target cancer cells

T cell expressing the CD-19 **antibody** against tumor cells after being genetically modified by inactive HIV

Inactive HIV

HIV modified t-cell with **antibody** will bind with CD-19 **antigen** on cancer cells and kill cancer cell by **apoptosis.**

Cancer cell with CD-19 **antigen** (receptor) protein

CD-19 Receptor

CD-19 antibody

HIV gets inserted into t-cell and changes genetic makeup to produce an **antibody** to target CD-19 receptor on tumor cells.

**Answer the following questions on a separate sheet of paper to turn in at the end of class.**

1.What do the scientists do to the HIV virus so that it will not give the patient HIV?

2. For what type of cancer has this treatment worked?

3.What do the t-cells produce after being injected with HIV that allows them to target cancer cells?

4. How many people have been successfully treated with the HIV injection?

5. Based on the diagram above explain what an antigen and an antibody are.

6. Cancer cells die in this mechanism by aPOPtosis. Taking into account the way I have just spelled the word for you, how do you think the cancer cells die?

7. Why is this research important?

8. These scientists who invented this treatment were once 10th grade biology students too. Everyone has to start from somewhere but this is where science can lead you. What will be your motivation or what can you take from this article that will help shape your mindset for this next unit on cell membrane function and transport?

A man with an aggressive form of cancer has gone into remission after receiving pioneering treatment involving the use of modified HIV cells. Marshall Jensen from Utah was diagnosed with leukaemia in early 2012 and had been receiving the gene therapy for the past few months.

Last year, seven-year old Emily Whitehead was given the [same treatment](https://www.youtube.com/watch?v=h6SzI2ZfPd4) and remains cancer free. But how does the therapy work and why are some experts still concerned about its use?

**What is the treatment and how does it work?**

Dr Carl June, a highly respected scientist in the field of cancer, HIV and immunology, and his team have been developing the pioneering the treatment for more than two decades at a research hospital in Pennsylvania.

The treatment, which costs roughly $20,000 per patient, essentially trains the immune system to recognise and kill tumour cells. Scientists extract healthy t-cells, a type of white blood cell that fights infection, and reprogramme them with modified version of the HIV virus. "It's a disabled virus," June explained. "But it retains the one essential feature of HIV, which is the ability to insert new genes into cells."

This new gene then "makes the cells go after cancer cells and then we put those cells back in the patient", explains Dr Stephan Grupp, the doctor who treated Whitehead. These cells then grow and multiply, creating an "an army of killer cells" that fight the disease, according to [Cancer Research UK](http://scienceblog.cancerresearchuk.org/2013/06/25/no-doctors-did-not-inject-hiv-into-a-dying-girl-to-treat-her-cancer/).

**How effective is it?**

Nine out of the 12 cancer patients who have received the treatment are in either full or partial remission, according to the Idaho-based [KSL](http://www.ksl.com/?sid=32280869&nid=148&fm=most_popular&s_cid=popular-2) news who reported on Jensen's remission. However, some of those patients went on to have different treatment, so it is unclear whether the gene therapy was solely responsible for their recovery.

"We make it clear when we talk to a family that it may not work", says Dr Gupp, and Cancer Research agrees that this is an important caveat. "It's clear that it doesn't work for everyone", it said.

**What are the other downsides?**

The treatment has severe side effects. Several patients suffered what is known as a "cytokine storm", a dangerous and potentially fatal reaction by the immune system which causes breathing difficulties and can also cause significant damage to organs.

Experts also stress that the treatment is still highly experimental and trials are still underway to establish its efficacy and safety. "There is a lot more work to be done to find out how best to use this new technology," said Cancer Research.

**What next?**

Scientists are working to extend its use beyond leukaemia, with Dr June planning to begin trials soon for pancreatic cancer.

"It's still early days for these exciting new approaches and there are many hurdles to jump," said Cancer Research, "but we're looking forward to the day when they can be used to treat patients on a wider scale." ·