



# CAR T-cell Therapy

## Why in News?

The **main treatments for cancer are surgery, radiotherapy and systemic therapy.**

- **Surgery and radiotherapy** have improved over time, but advances in systemic therapy have been particularly impressive, with **Chimeric antigen receptor (CAR) T-cell therapy** being a recent breakthrough attracting global attention.

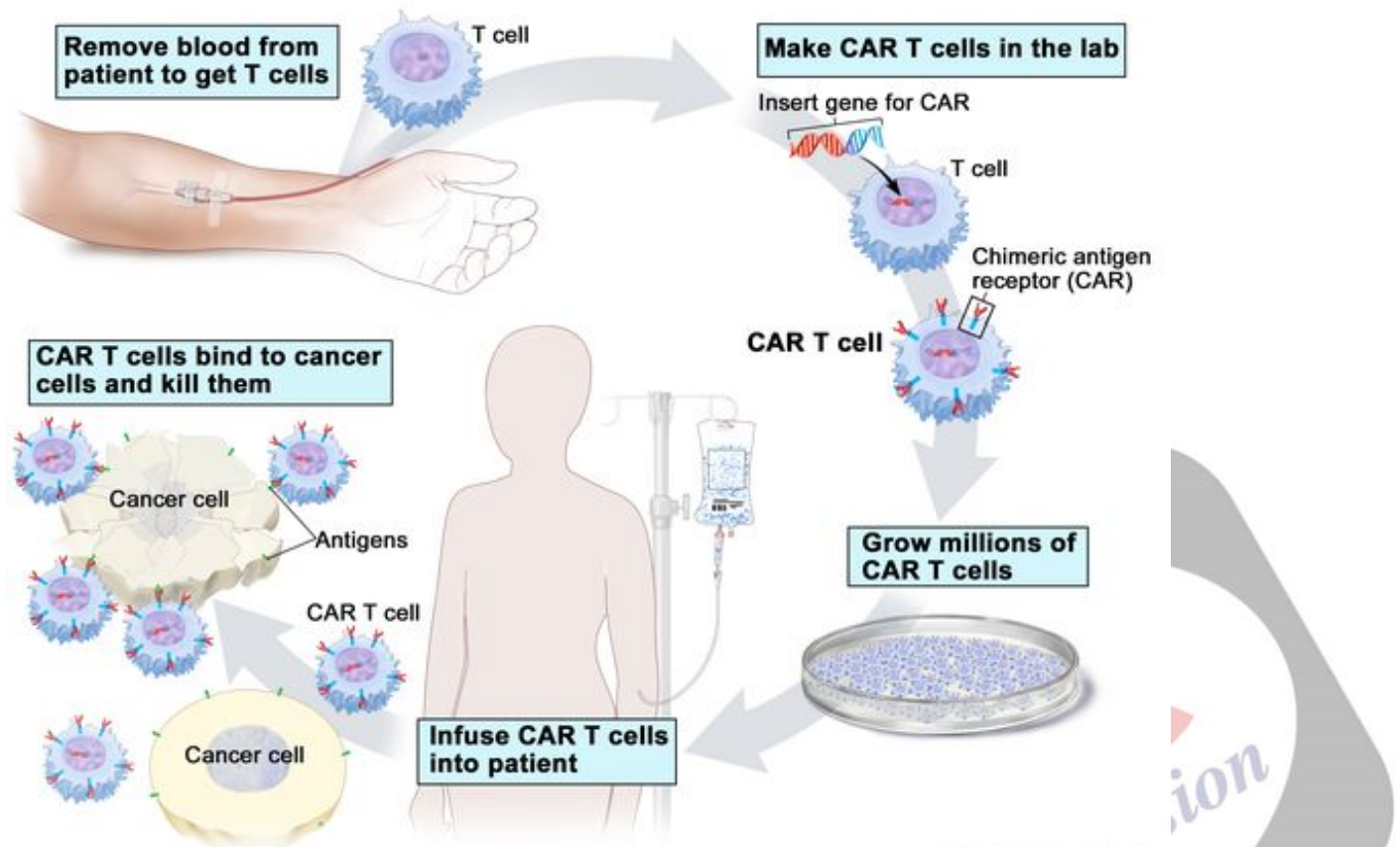
## What are the Major Interventions in Systemic Therapy for Cancer Treatment?

- **Systemic therapy** began with [chemotherapy](#), which attacks cancer cells due to their fast growth.
  - **Chemotherapy** drugs have limited success and significant side effects because they affect many types of cells in the body.
- The next advancement was **targeted agents**, also known as [immunotherapy](#), which work by **binding to specific targets on the cancer or immune cells** supporting its growth.
  - This **approach is less toxic as it affects fewer non-tumor cells**, but only works on tumours that have these targets.

## What is CAR T-cell Therapy?

- **About:**
  - **CAR T-cell therapies** are a major breakthrough in cancer treatment.
    - Unlike **chemotherapy or immunotherapy which involve taking drugs**, CAR T-cell therapies **use a patient's own cells**. They are **modified in the laboratory to activate T-cells** and target tumor cells.
  - **CAR T-cell therapy** has been **approved for leukaemias** (cancers arising from the cells that produce white blood cells) and **lymphomas** (arising from the lymphatic system).
- **Procedure:**
  - T cells are taken from a patient's blood and then the **gene for a special receptor that binds to a certain protein on the patient's cancer cells is added to the T cells** in the laboratory.
    - The special receptor is called a **chimeric antigen receptor (CAR)**. Large numbers of the **CAR T cells are grown in the laboratory** and given to the patient by infusion.

## CAR T-cell Therapy



- **Significance:**

- **CAR T-cell therapies are even more specific** than targeted agents and directly **stimulate the patient's immune system to fight cancer**, leading to greater clinical efficacy.
  - That's why they're referred to as **"living drugs."**

- **Challenges:**

- **Preparation:**
  - The **difficulty of preparing CAR T-cell therapies** has been a major hindrance to their widespread use.
  - The **first successful clinical trial was published a decade ago**, and the **first indigenously developed therapy in India was performed in 2021**.
- **Side Effects:**
  - In certain kinds of leukaemias and lymphomas, the efficacy is as high as 90%, whereas in other types of cancers it is significantly lower.
  - The potential **side-effects are also significant**, associated with **cytokine release syndrome** (a widespread activation of the immune system and collateral damage to the body's normal cells) and **neurological symptoms** (severe confusion, seizures, and speech impairment).

- **Affordability:**

- Introduction of CAR T-cell therapy in India can **face challenges of cost and value**.
- Critics argue that **developing CAR T-cell therapy in India may not be cost-effective** as it will still be unaffordable for most people.

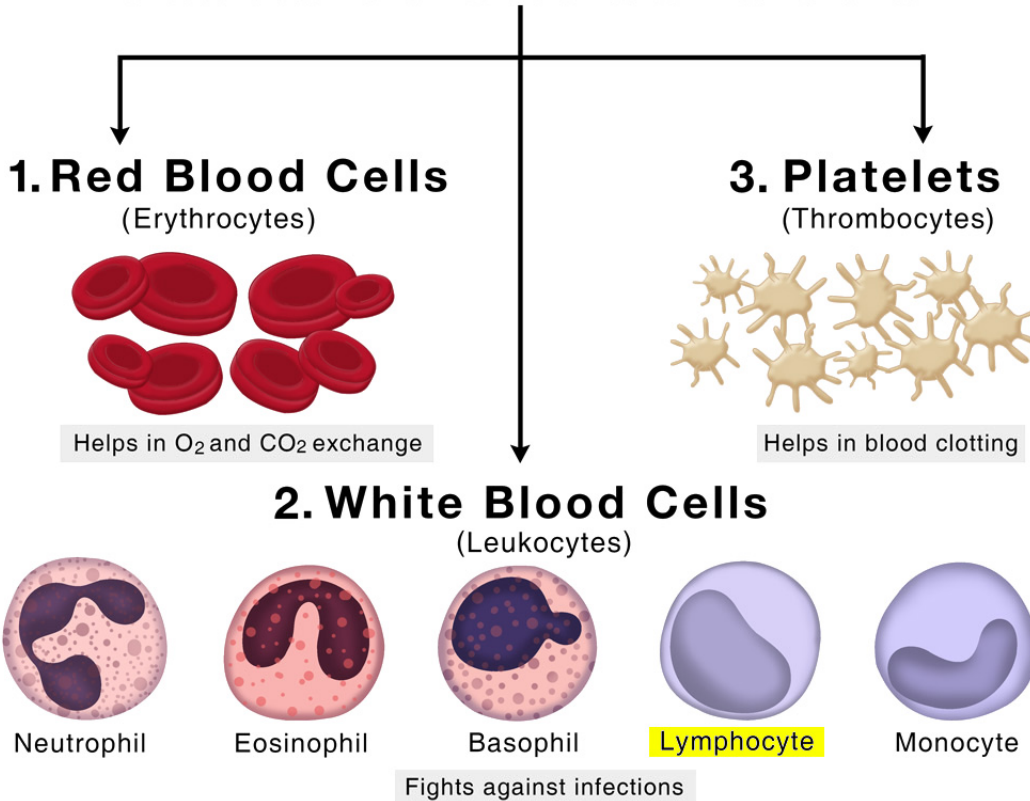
## What are T Cells?

- T cells, also known as **T lymphocytes**, are a **type of white blood cell** that play a central role in the immune response.
- T cells are involved in **cell-mediated immunity, which means they help the body recognize and respond to foreign substances**, such as viruses, bacteria, and abnormal cells, such as

cancer cells.

- There are two major types of T cells: the helper T cell and the cytotoxic T cell.
  - As the names suggest, helper T cells 'help' other cells of the immune system, whilst cytotoxic T cells kill virally infected cells and tumors.

## TYPES OF BLOOD CELLS



### What are the Government Initiatives Related to Cancer Treatment?

- [National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke](#)
- [National Cancer Grid](#)
- [National Cancer Awareness Day](#)

### UPSC Civil Services Examination, Previous Year Question (PYQ)

**Q. Which one of the following statements best describes the role of B cells and T cells in the human body?(2022)**

- (a) They protect the environmental allergens. body
- (b) They alleviate the body's pain and inflammation.
- (c) They act as immunosuppressants in the body.
- (d) They protect the body from the diseases caused by pathogens.

**Ans: (d)**

[Source: TH](#)

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