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DAILY CURRENT AFFAIRS



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TOPIC

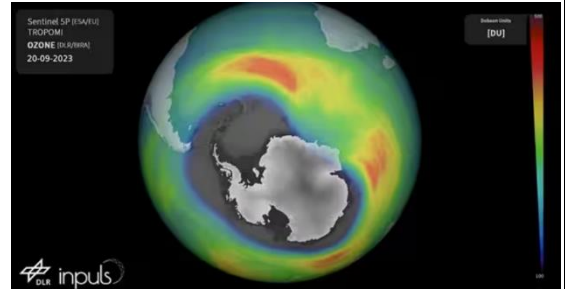
1.	LARGE OZONE HOLE DETECTED OVER ANTARCTICA
2.	CDSO APPROVES IMMUNOACT'S CAR-T CELL THERAPY

LARGE OZONE HOLE DETECTED OVER ANTARCTICA

SOURCE: [IE](#)

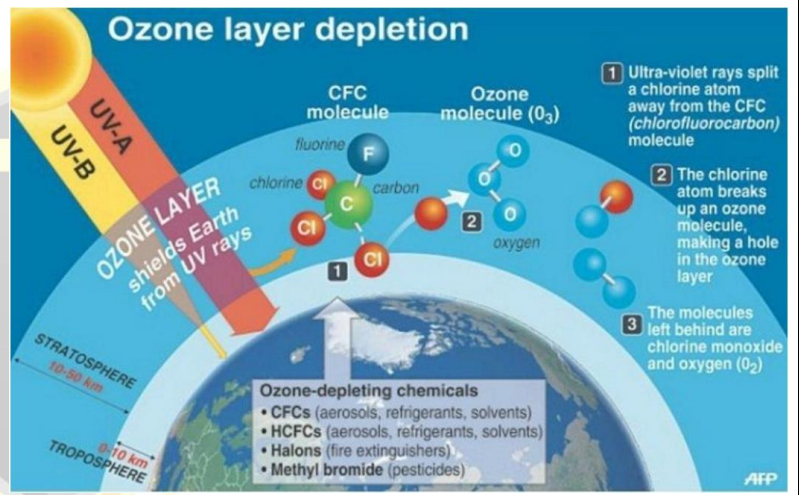
WHY IN NEWS?

The **European Space Agency Copernicus Sentinel-5P satellite has detected a 26 million square kilometres giant hole in the ozone layer.** The ozone hole **over Antarctica** is one of the biggest on record, roughly three times the size of Brazil. It's a natural phenomenon, but scientists are concerned climate change could begin reopening ozone holes.



ABOUT OZONE:

- ❖ Typically, the oxygen molecule found in the air we breathe consists of two oxygen atoms (O₂), denoted as O₂, where the "2" indicates the number of oxygen atoms.
- ❖ In contrast, ozone is another oxygen-containing molecule but contains three oxygen atoms (O₃). Unlike O₂, which comprises two oxygen atoms, O₃ has three oxygen atoms within its structure.
- ❖ Oxygen in the form of O₂ makes up approximately 21% of the Earth's atmosphere, while ozone accounts for less than 0.001% of the atmosphere.



- ❖ **PRODUCTION OF OZONE:**
 - Ozone molecules are generated through the interaction of ultraviolet (UV) radiation emitted by the Sun with O₂ molecules.
 - This process involves the splitting of O₂ molecules, with the resulting free oxygen atoms bonding with other O₂ molecules to create O₃ molecules.
- ❖ **THE OZONE LAYER:**
 - Since UV radiation is more concentrated at higher altitudes where the air is thinner, ozone production primarily occurs in the stratosphere. This phenomenon is responsible for the formation of the "ozone layer."
 - The ozone layer spans an altitude range of approximately 10 to 40 kilometres, with its peak concentration at about 25 kilometres.
- ❖ **SIGNIFICANCE OF THE OZONE LAYER:**
 - The ozone layer plays a crucial role in preserving life on Earth because it possesses the unique ability to absorb the most harmful type of UV radiation known as UV-B radiation.
 - UV-B radiation is characterized by a wavelength falling within the range of 280 to 315 nanometres.
 - It is important to note that extensive exposure to high levels of UV radiation is a major cause of many skin cancers. Consequently, protective shielding from UV rays significantly contributes to the reduction of cancer rates.



❖ STRATOSPHERIC TEMPERATURE EFFECTS:

- As UV radiation is absorbed by ozone in the stratosphere, it leads to the heating of the surrounding air, thereby creating a temperature inversion in the stratosphere.

❖ MEASURING STRATOSPHERIC OZONE:

- The measurement of ozone is expressed in Dobson units, which represents the total amount present in a column of the overlying atmosphere.
- A single Dobson unit can be envisioned as the quantity of ozone that would form a layer with a thickness of 0.01 millimetres under standard sea-level pressure and temperature conditions.

LARGE OZONE HOLE OVER ANTARCTICA: CAUSES AND IMPLICATIONS

❖ OZONE HOLE DYNAMICS:

- The ozone hole over Antarctica undergoes annual variations, appearing in August and closing in November or December.
- This phenomenon is attributed to the Earth's rotation, which results in specific winds over Antarctica, creating a unique microclimate that shields the region from surrounding air. When these winds subside, the ozone hole naturally closes.



❖ FACTORS BEHIND THE ENLARGED OZONE HOLE:

- The substantial ozone hole observed in recent times may be linked to volcanic eruptions in Tonga (December 2022 and January 2023).
- Typically, gases released by volcanic eruptions remain below the stratosphere. However, this particular eruption introduced a significant amount of water vapor into the stratosphere, affecting the ozone layer through chemical reactions and altering its heating pattern.
- Additionally, the water vapor contained elements like bromine and iodine, which can contribute to ozone depletion.

UNDERSTANDING ULTRAVIOLET (UV) RADIATION

- ✓ UV radiation comprises wavelengths **shorter than those visible to the naked eye.**
- ✓ It's categorized into three types based on wavelength: UV-A, UV-B, and UV-C.
- ✓ **UV-A:** Long-wavelength radiation, constituting 95% of UV radiation reaching Earth's surface, characterized by its deep penetration.
- ✓ **UV-B:** Short-wavelength radiation that primarily affects the outer skin layer (epidermis) and is absorbed by Earth's ozone layer.
- ✓ **UV-C:** The highest energy segment within the UV radiation spectrum, with wavelengths blocked by the ozone layer.

❖ HUMAN INFLUENCE AND CLIMATE CHANGE:

- Current evidence does not strongly support human activities as the primary cause of ozone holes.
- While ozone depletion is distinct from global climate change, there are indications that rising global temperatures could be influencing ozone holes.
- Mitigation efforts to reduce ozone holes have been effective since the 1980s, but recent occurrences, such as the deep and prolonged ozone holes in 2020 and 2021, have raised concerns.
- Research has suggested that factors like wildfires in southeastern Australia in 2020 played a significant role in the formation of the large ozone hole.

❖ OZONE HOLES AND CLIMATE EFFECTS:

- The impact of ozone holes on Earth's climate remains a topic of ongoing research. Some data indicates that ozone holes might contribute to cooling effects by reducing the greenhouse gas effect.



INTERNATIONAL AGREEMENTS FOR OZONE LAYER PROTECTION

- ✚ **Vienna Convention:** The inaugural agreement focusing on safeguarding the ozone layer. Its primary aim is to encourage international collaboration among nations, facilitating the exchange of insights regarding the consequences of human actions.
- ✚ **Montreal Protocol:** This groundbreaking multilateral accord, established in 1987, addresses Substances that Deplete the Ozone Layer. It governs the production and consumption of nearly 100 artificial compounds known as ozone-depleting substances (ODS).
- ✚ **Kigali Agreement:** An accord reached in Kigali, involving approximately 197 nations, including major players like India, China, and the USA. The agreement seeks to curtail the utilization of hydrofluorocarbons (HFCs) by approximately 85% of their respective baselines by 2045. This adjustment to the 1987 Montreal Protocol demonstrates global commitment to ozone layer preservation.





CDSCO APPROVES IMMUNOACT'S CAR-T CELL THERAPY

SOURCE: [THE HINDU](#)

WHY IN NEWS?

- ImmunoACT, an IIT Bombay-incubated company, has obtained marketing authorization approval from the Central Drugs Standard Control Organisation (CDSCO) for its CAR-T cell therapy product.
- It is the first humanised CD19 targeted CART cell therapy for relapsed/ refractory B-cell Lymphomas and Leukaemia (blood Cancer) in India.

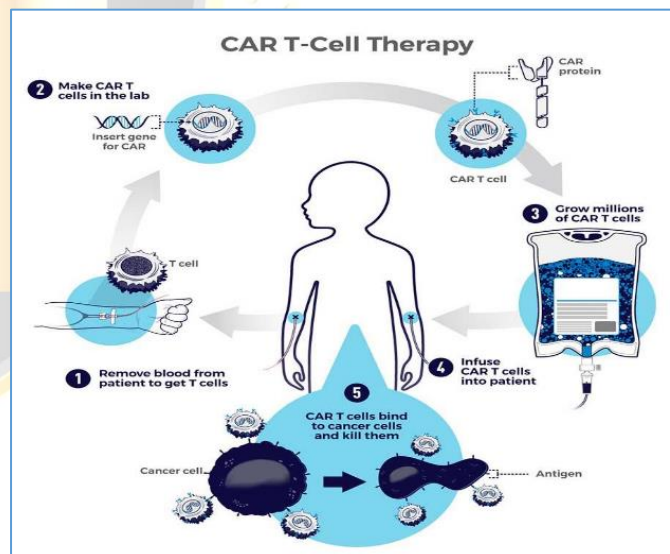
KEY PRODUCT INFORMATION:

- The CAR-T cell therapy product is named **NexCAR19 (Actalycabtagene autoleucel)**.
- ImmunoACT aims to make NexCAR19 available to its partner hospitals in India at the earliest.
- The product is the result of a decade-long collaborative effort between IIT Bombay and Tata Memorial Centre.
- Designed and developed at IIT Bombay, NexCAR19 underwent process development and manufacturing under current Good Manufacturing Practices (cGMP) at ImmunoACT.



UNDERSTANDING CAR T-CELL THERAPY:

- **About CAR T-Cell Therapy**
 - ✓ Chimeric Antigen Receptor (CAR) T-cell therapy represents a major breakthrough in cancer treatment.
 - ✓ Unlike chemotherapy or immunotherapy involving drugs, CAR T-cell therapies use a patient's cells, modifying them in the lab to activate T-cells and target tumor cells.
 - ✓ CAR T-cell therapy has been approved for treating leukemia and lymphomas.
- **Procedure:**
 - ✓ T cells are extracted from the patient's blood.
 - ✓ A special receptor called a Chimeric Antigen Receptor (CAR) that binds to specific proteins on the patient's cancer cells is added to the T cells in the lab.
 - ✓ Large quantities of CAR T cells are grown and then infused into the patient.

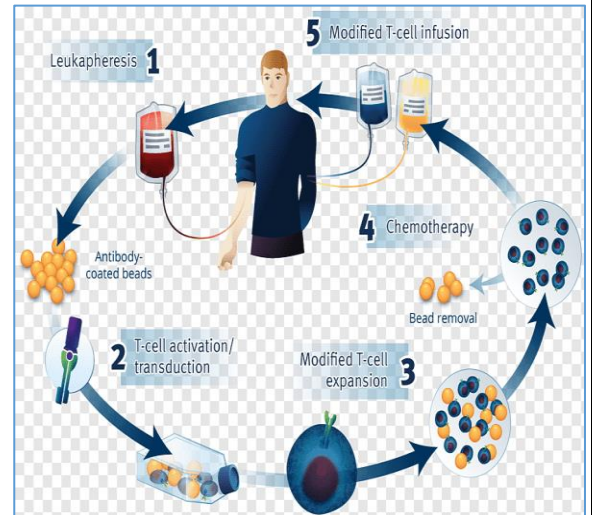


HOW CAR T-CELL THERAPY WORKS:

- **Targeted Conditions:**
 - ✓ CAR T-cell therapy focuses on treating leukemia and lymphoma.
 - ✓ Leukemia is a cancer that affects blood-forming tissues, including the bone marrow.
 - ✓ Lymphoma is a cancer of the lymphatic system, a critical component of the body's immune defenses.
- **Lentiviral Technology:**



- ✓ This therapy employs **lentiviral technology**, which is a method used in gene therapy to insert, modify, or delete genes in organisms.
- ✓ **Lentiviruses** are a family of viruses, known for diseases like **AIDS (acquired immunodeficiency syndrome)**.
- **Modification of T Cells:**
 - ✓ Specific **white blood cells called T cells** are extracted from the **patient's body**.
 - ✓ These T cells are modified in the laboratory to enable them to recognize and target cancer cells effectively.
- **Cell-Based Gene Therapy:**
 - ✓ CAR T-cell therapy is considered a **type of cell-based gene therapy**.
 - ✓ It involves **genetic alterations made within T cells**, enhancing their ability to **identify and attack cancerous cells**.



SIGNIFICANCE:

- CAR T-cell therapies are **highly specific and stimulate the patient's immune system** to combat cancer directly, leading to improved clinical effectiveness.
- They are often referred to as "**living drugs**."
- This **indigenously-developed product** places India on the global map of **advanced cell and gene therapies**.
- **Laurus Labs**, holding **approximately 34% stake in ImmunoACT**, has been a **significant supporter of the company with an investment of over \$18 million for R&D** and commercialization efforts.
- **ImmunoACT's achievement** is a **milestone** in the field of **blood cancer treatment**, offering advanced and innovative therapy options.

CHALLENGES

- **Infrastructure and Expertise:**
 - ✓ Building infrastructure and **expertise for CAR T-cell therapy in India** is a significant challenge.
 - ✓ Establishing **specialized laboratories** and training healthcare professionals in this advanced field of **gene therapy requires substantial investment** and resources.
- **Clinical Trials and Research:**
 - ✓ **Expanding clinical trials and research** efforts to include a **broader spectrum of cancer types** is crucial.
 - ✓ India should invest in research to **enhance the understanding of CAR T-cell therapy's effectiveness** in various cancer conditions.
- **Patient Awareness and Education:**
 - ✓ Raising awareness and educating patients and their **families about CAR T-cell therapy is vital**.
 - ✓ Many **patients may not be familiar with this treatment option**, and there is a **need for educational initiatives to ensure they make informed decisions**.
- **Ethical Considerations:**
 - ✓ Ethical considerations surrounding **gene therapies, including CAR T-cell therapy, need careful examination**.
 - ✓ Balancing innovation with **ethical concerns related to genetic modification** and patient consent is an ongoing challenge.
- **Collaboration and Research Funding:**
 - ✓ Collaborating with international partners and **securing adequate research funding for CAR T-cell therapy is crucial**.



- ✓ India must **actively participate in the global research community** to stay updated with advancements.

GOVERNMENT INITIATIVE

<i>Initiative</i>	<i>Objective</i>
National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases, and Stroke	Implement comprehensive prevention and control strategies for cancer, diabetes, cardiovascular diseases, and stroke.
National Cancer Grid	Facilitate collaboration among cancer treatment centers, research institutions, and healthcare professionals to improve cancer care and research.
National Cancer Awareness Day	Raise awareness about cancer, its prevention, early detection, and available treatments among the public.
Pradhan Mantri National Dialysis Program (PMNDP)	Provide free dialysis services to underprivileged citizens suffering from kidney failure.
Ayushman Bharat - Pradhan Mantri Jan Arogya Yojana (PM-JAY)	Offer financial protection to vulnerable families by providing access to a range of medical services, including cancer treatment.
National Cancer Institute (NCI)	Establish a world-class research institution dedicated to cancer treatment and research in India.
Tobacco Control Programs	Implement anti-tobacco campaigns and regulations to reduce tobacco-related cancers.
Palliative Care Initiatives	Improve access to palliative care services for cancer patients to enhance their quality of life.
National Health Mission (NHM)	Enhance healthcare infrastructure and services to provide comprehensive care , including cancer screening and treatment.
Cancer Screening Camps	Organize screening camps to detect cancer at an early stage, especially in rural and underserved areas.

WAY FORWARD

- **Research and Development:**
 - ✓ Establish dedicated **research facilities and allocate funds for advancing CAR T-cell therapy** research in India.
 - ✓ Promote collaboration between research **institutions, universities, and the pharmaceutical industry to accelerate research and development.**
- **Clinical Trials and Regulations:**
 - ✓ **Encourage clinical trials for CAR T-cell therapies** to assess their efficacy and safety for different cancer types.
 - ✓ **Streamline regulatory processes to expedite approvals for CAR T-cell therapy** products while ensuring patient safety.
- **Capacity Building:**
 - ✓ **Invest in infrastructure and skilled personnel** for the production and **administration of CAR T-cell therapies.**
 - ✓ Train healthcare professionals in the administration, monitoring, and **management of CAR T-cell therapy-related side effects.**
- **Affordability and Accessibility:**
 - ✓ **Explore cost-effective manufacturing techniques** to reduce the **overall cost of CAR T-cell therapies.**



- ✓ Develop **public-private partnerships** to make these **therapies accessible to a broader population**.

Prelims Specific

Gene Therapy

Gene therapy is a **medical approach aimed at altering an individual's genetic makeup** to address or eliminate various diseases.

This innovative method operates through several mechanisms:

- **Gene Replacement:** Substituting a defective gene responsible for a disease with a functional and healthy version of the same gene.
- **Gene Inactivation:** Disabling or deactivating a malfunctioning gene that is causing or contributing to a disease.
- **Gene Introduction:** Introducing a newly created or modified gene into the body to aid in the treatment of a specific condition.

Difference between Gene therapy and Gene editing:

Aspect	Gene Therapy	Gene Editing
Primary Goal	To introduce functional genes or modify gene expression to treat diseases.	To directly alter, revise, remove, or replace specific genes or DNA sequences.
Alteration Level	Modifies gene expression without necessarily changing the existing gene.	Edits or modifies the DNA at the gene level, potentially replacing or removing specific genes.
Disease Treatment	Compensates for the effects of a mutated gene by adding a healthy version.	Corrects or eliminates disease-causing genes or mutations at the genetic level.
Mutated Genes	The mutated or disease-related genes usually remain in the genome.	Targeted genes or mutations are directly altered, potentially leading to their elimination or modification.
Potential Benefits	Offers a way to treat genetic disorders and diseases by introducing functional genes.	Provides the ability to correct genetic defects, eradicate mutated genes, or engineer specific genetic traits.
Use Cases	Often used for compensating for dysfunctional genes and addressing genetic disorders.	Commonly employed in applications like creating genetically modified organisms, developing designer babies, or treating genetic conditions at their root.
Degree of Change	Generally involves changes in gene expression, not gene replacement.	Involves altering genes at their fundamental DNA level, which may include gene replacement or elimination.