

1. **International Conference on Disaster Resilient Infrastructure (ICDRI)2025:** Recently, the Prime Minister of India addressed **the ICDRI 2025**, presenting a bold global vision to strengthen disaster preparedness and advance the development of resilient infrastructure worldwide.
  - **About ICDRI:** Annual global conference of **Coalition for Disaster Resilient Infrastructure(CDRI)**, organized in collaboration with member countries, organizations, and institutions.
    - **Aim:** To strengthen international discourse and cooperation on disaster and climate-resilient infrastructure.
  - **Key Highlights: Theme:** “Shaping a Resilient Future for Coastal Regions”, focusing on the vulnerability of coastal and island regions to disasters.
    - Cited recent cyclones and hurricanes across Asia, Africa, and the Americas.
    - **India’s Role:** Built cyclone shelters post-1999; tsunami warning system benefits 29 countries.
    - Recognized as Large Ocean Countries; CDRI working with 25 Small Island Developing States on resilient infrastructure.
  - **About CDRI:** A global multi-stakeholder partnership comprising national governments, UN agencies, multilateral development banks, the private sector, and academic institutions.
    - **Launched by** the Prime Minister of India during the **UN Climate Action Summit on 23rd September 2019**.
    - To promote the resilience of new and existing infrastructure systems against climate and disaster risks, supporting sustainable development.
    - Includes 30 countries and 8 international organizations.
2. **HKU5 Virus:** Recently, researchers from US institutions warned about a subgroup of **bat coronaviruses called HKU5**, which could be just one mutation away from infecting humans and potentially causing the next global pandemic.
  - **About HKU5:** A newly discovered bat coronavirus belonging to the merbecovirus subgenus, which also includes MERS-CoV known for its high fatality rate.
    - It uses the **ACE2 receptor** to enter cells, the same receptor targeted by SARS-CoV-2, but currently binds effectively only to the bat version of ACE2.
    - Found across Asia, Europe, Africa, and the Middle East, showing a wide geographical spread.

- Research has shown HKU5 has crossed species barriers by infecting mink populations.
- It can bind to ACE2 receptors in multiple mammalian species, indicating possible spread through intermediate animals before reaching humans.

**3. Vithoot Programme** Recently, Kerala's Forest Department introduced an ambitious afforestation program called Vithoot, which means "seed shower."

- **About Vithoot Programme:** It aims to speed up forest regeneration, boost biodiversity, and reduce human-wildlife conflicts by restoring habitats and food sources.
  - **It uses:** Aerial distribution of thousands of seed balls over forests, degraded lands, and open spaces, a first of its kind in India.
  - **Aim:** To speed up forest regeneration, boost biodiversity, and reduce human-wildlife conflicts by restoring habitats and food sources.
  - Community involvement, especially students, is encouraged, combining participation with technology like drones and helicopters.
  - The **Kerala Forest Research Institute (KFRI)** manages seed identification, collection, and seed ball preparation—compact mixtures of soil, compost, and seeds that support germination.
  - **Seed balls** are deployed in ecologically sensitive areas like landslide and wildfire zones, abandoned plantations, reservoir catchments, tribal farming lands, and under power lines.
  - Focuses on native species such as fruit trees, bamboo, and fast-growing grasses to create microclimates that boost forest health and climate resilience.
  - **Benefits:** Improved access to non-timber forest products, reduced human-wildlife conflict, enhanced water security, climate adaptation, and greater public engagement in conservation.

**4. Escherichia Coli :** Recently, antimicrobial resistance (AMR) has emerged as a major global health threat, causing about five million deaths annually and expected to double by 2050.

- Scientists are revisiting bacteriophages—viruses that specifically target bacteria such as *Escherichia coli*—as a potential alternative.
- **About Escherichia coli (E. coli):** A rod-shaped bacterium from the Enterobacteriaceae family, commonly found in the intestines of humans and animals.

- Most strains are harmless or beneficial, but some cause illnesses like diarrhea, urinary tract infections, respiratory illness, and pneumonia.
- Transmission occurs through contaminated food, water, or contact with fecal matter from infected humans or animals.
- Harmful strains produce Shiga toxin, which damages the small intestine lining and causes diarrhea; these are known as Shiga toxin-producing *E. coli* (STEC).
- **About Bacteriophages:** Viruses that specifically infect and kill bacteria, acting as natural bacterial predators. They are found everywhere—in water, soil, on skin, or in the gut and are about ten times more numerous than bacteria worldwide.
  - Composed of nucleic acid (DNA or RNA, single or double-stranded) enclosed in a protein coat.
  - Unlike broad-spectrum antibiotics, these are highly specific, usually targeting only a few strains of a particular bacterium.
  - Used for treating burns, foot ulcers, gut infections, respiratory infections, and urinary tract infections.
- 5. **<sup>188</sup>At (astatine):** Recently, researchers from around the world identified and determined the half-life of <sup>188</sup>At (astatine), the heaviest known isotope to emit a proton during its decay process.
  - **About <sup>188</sup>At:** A radioactive isotope of astatine, a rare halogen element.
    - **Atomic number:** 85; Half-life: ~7.2 hours.
    - It undergoes **alpha decay**, emitting high-energy alpha particles.
    - **Produced in cyclotrons** by bombarding bismuth-209 with alpha particles or via generators using radium-224.
  - **Medical Significance:** Used in cancer treatment due to its short-range, high-energy alpha emissions Targeted Alpha Therapy (TAT).
    - Delivers localized damage to tumor cells with minimal impact on healthy tissues.
    - Suitable for treating thyroid, ovarian, brain, and prostate cancers.
  - **Proton Emission:** A rare type of radioactive decay where an unstable nucleus ejects a proton to become more stable. It is one of several ways atoms release energy and particles during radioactive decay, alongside processes like alpha or beta decay and electron capture.

## 6. Stratospheric Aerosol Injection (SAI):

Recently, scientists have started exploring geoengineering methods like Stratospheric Aerosol Injection (SAI) as a new way to help cool the Earth, as global temperatures continue to rise.

- **About SAI:** A geoengineering technique that involves releasing reflective particles, such as sulphur dioxide, into the **stratosphere (10–50 km above Earth's surface)**.
  - **Goal:** To reflect a portion of incoming sunlight back into space to reduce global temperatures.
  - It mimics the cooling effect observed after major volcanic eruptions.
  - Falls under the broader category of Solar Radiation Management (SRM) techniques.

## What is stratospheric aerosol injection and why do we need to govern it?



Climate change is already here.

The world is not reducing and removing emissions fast enough to avoid dangerous global warming. Scientists are exploring new ideas to cool the planet.

It is called **Stratospheric Aerosol Injection (SAI)**. The idea is to spray particles in the stratosphere, which would reflect sunlight and reduce global temperatures. It could be relatively cheap to deploy, and quick acting.

But it also brings **big risks**.

And there are **no effective global systems** in place to govern it.

We have no time to waste. The window may be closing to **create effective governance** that looks at all tools potentially available.

It could have **unequal effects**. One place could get more rain, another could get less.



Stopping it suddenly could cause rapid temperature rise that would be disruptive to human society and be dangerous for many species.

Depending on the materials it uses, it could damage the ozone layer. This can cause health and environmental problems.



Countries might disagree on its use, and some might act alone, creating geopolitical and security tensions.

These and other risks must be measured against the **growing dangers of a rapidly warming planet**.

## 7. Magnetic Isolation and Concentration cryo-electron microscopy (MagIC):

Recently, researchers in the U.S. developed a new technique called Magnetic Isolation and Concentration cryo-electron microscopy (MagIC) as an innovative workaround for enhancing imaging in structural biology.

- **About MagIC :** Enables imaging of samples 100 times more dilute than traditional methods by attaching molecules to 50-nanometer magnetic beads.
  - These beads are clumped together using a magnet, physically concentrating the molecules and making them easily visible even at low magnification, which speeds up targeting in the microscope.
  - The technique produces multiple usable images at very low molecule concentrations (~0.0005 mg/ml, reducing sample needs to just 5 nanograms per grid).

- Image quality is enhanced using DuSTER (Duplicated Selection To Exclude Rubbish), a computational workflow that selects particles twice to remove false positives and improve clarity.
- **About Cryo-Electron Microscopy (Cryo-EM):** An advanced electron microscopy technique that creates detailed 3D images of biomolecules by combining thousands of projections.
  - It freezes samples at cryogenic temperatures (around -150°C), preserving their natural structure without damage.
  - This allows scientists to visualize biological processes and molecular structures, such as viruses and protein complexes, at near-atomic resolution.
- 8. **mRNA Technology:** Recently, researchers developed a new method using mRNA technology, similar to that in COVID-19 vaccines, to **cure the hidden HIV virus**.
  - **Key Highlights:** The team developed a **new lipid nanoparticle called LNP X**, a tiny fat bubble designed to deliver mRNA directly into white blood cells harboring HIV.
    - The delivered mRNA instructs these cells **to expose/wake-up the hidden virus**, effectively “lighting it up” for detection and targeting. This marks the first successful mRNA delivery into this specific type of white blood cell.
  - **About mRNA (Messenger RNA):** A **single-stranded RNA** molecule involved in the process of protein synthesis and created from a DNA template during transcription.
    - mRNA carries genetic information from DNA in the cell’s nucleus to the cytoplasm, where proteins are made.
  - **HIV (Human Immunodeficiency Virus) :** Retrovirus carrying genetic instructions in RNA form.
    - It targets and destroys CD4 cells (CD4 T lymphocytes), crucial white blood cells that protect the body from infections.
    - It converts its RNA into DNA inside host cells and this DNA integrates into the host genome, hijacking the cell to produce more viruses.
    - Antiretroviral Therapy (ART) treats HIV infection using anti-HIV drugs.
    - Untreated HIV can lead to Acquired Immunodeficiency Syndrome (AIDS).