SCIENCE AND TECHNOLOGY

1. GENOME INDIA PROJECT

News: The Genome India Project (GIP) has reached a major milestone by making genomic data of 10,000 individuals publicly available. The whole genome sequencing data of 10,000 individuals is stored at the Indian Biological Data Centre (IBDC) Faridabad.

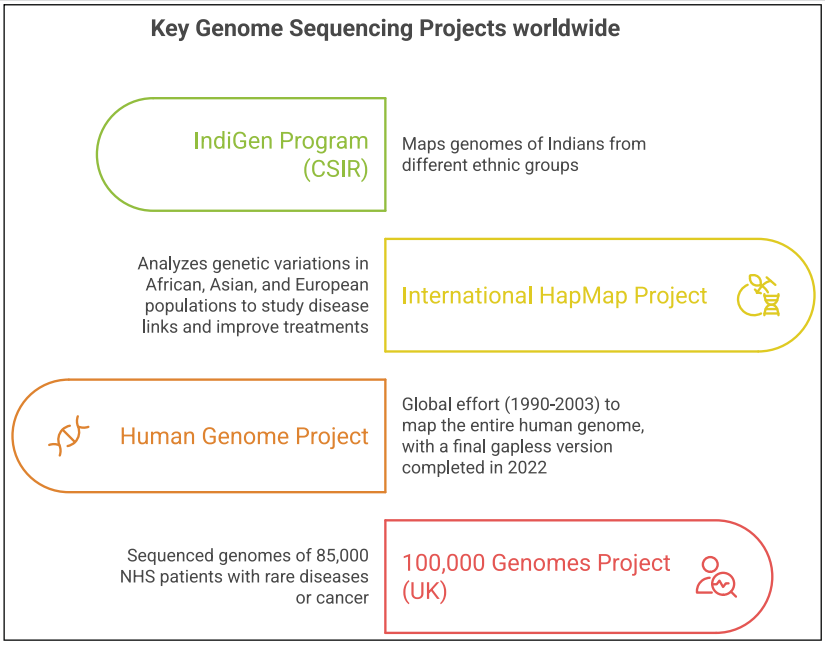
About Genome India Project (GIP)

- It was launched in 2020 by the **Department of Biotechnology (DBT),** Government of India, in collaboration with 20 institutions to map India's genetic diversity.
- **Primary objective-** To create a detailed catalogue of genetic variations to represent India's unique genetic diversity.
- **Key achievements:**
  - Collected 20,000 samples from 83 diverse populations, establishing a biobank.
  - Sequenced 10,000 genomes in the first phase, developing a reference genome for India.

Genome- A genome is the complete **set of genetic material (DNA or RNA) present in an individual or species**. It contains all the information needed for an organism's growth, function, and survival.

Genome sequencing- It is the process of decoding the complete genetic sequence of an organism. It identifies the exact order of nucleotide bases **(A, T, C, G, U)** in the DNA/RNA strand, which store biological information essential for life.

Applications- Genome sequencing is used in **healthcare, epidemic control, agriculture, and biodiversity conservation** to enhance disease research, develop vaccines, improve crops, and study species evolution.



2. NATIONAL GENE BANK

News: The Government of India has announced the creation of a Second National Gene Bank to conserve 10 lakh crop germplasm. This initiative aligns with the "Investing in Innovations" theme of the Union Budget 2025-26.

Gene Bank

- A Gene Bank is a specialized storage facility designed to preserve seeds, pollen, and plant tissues to safeguard plant species from extinction and ensure their availability for future needs.
- These preserved samples play a vital role in crop breeding, scientific research, and biodiversity conservation.

India's First National Gene Bank

- It was established in 1996 by the Indian Council of Agricultural Research – National Bureau of Plant Genetic Resources (ICAR-NBPGR) in New Delhi.

Current status:

- It is the second-largest Gene Bank globally, following the Svalbard Global Seed Vault in Norway.
- It houses 4,71,561 accessions spanning 2,157 species.
- It supplies plant genetic resources to both public and private entities engaged in crop improvement and genetic conservation.

National Bureau of Plant Genetic Resources (NBPGR)

- It is the apex institution under ICAR responsible for plant genetic resource management.
- **Objective:** Conservation, evaluation, and utilization of plant genetic resources to support sustainable agriculture and food security**.**
- **Headquarters:** New Delhi

3. BOLLGARD-3

News: Recently, there has been an increasing demand for Bollgard-3 in Punjab, ahead of the cotton sowing season**.**

About Bollgard-3

- It is a new **pest-resistant genetically-modified (GM) cotton variety**.
- It was developed by **Monsanto** more than a decade ago, and shows remarkable resistance to pests.
- It contains **three Bt proteins Cry1Ac, Cry2Ab and Vip3A** that cause insect death by disrupting their normal gut function. This in turn allows for the growth of a healthier cotton crop, and increases yield.
- Farmers are demanding the introduction of Bollgard-3, which is particularly effective against lepidopteran pests like **pink bollworm.**
- Bollgard-1 was a Monsanto-developed Bt cotton introduced in India in 2002, followed by Bollgard-2 in 2006. The latter remains prevalent today.

- Although these do have some pest-repellent properties, they are not effective against the whitefly and the pink bollworm, which arrived in Punjab in 2015-16 and 2018-19 respectively.
- **Bacillus Thuringiensis:**
  - Bacillus thuringiensis (Bt) is a soil-dwelling bacterium with potent insecticidal properties.
  - In the past few decades, researchers have successfully inserted certain genes from Bt in various crops, like cotton, providing these with insect-repellent properties.

4. ISRO'S THIRD LAUNCH PAD

News: Union Cabinet approved the establishment of 'Third Launch Pad' (TLP) project at Satish Dhawan Space Centre of ISRO at Sriharikota, Andhra Pradesh.

About Third Launch Pad

- It is designed to support the launch of **Next Generation Launch Vehicles (NGLV)** and **Launch Vehicle Mark-3 (LVM3)** with a semi-cryogenic stage and upgraded NGLV configurations.
- It is also supported as a standby launch pad for the Second Launch Pad at Sriharikota.
- It is expected to be operational within 4 years.
- **Significance**:
  - **Increases Launch Capacity**: Enhances launch frequency and supports future human spaceflight and space exploration missions.
  - **Advances India's Space Vision**: Essential for India's long-term goals, including the Bharatiya Antariksh Station (BAS) by 2035 and an Indian Crewed Lunar Landing by 2040.
  - **Future Space Transportation**: Ensures India meets evolving space transportation needs for the next 25-30 years.

Reasons for Choosing Sriharikota for Satellite Launch Pads

- **Eastern Coast Location** – Enables launches in an easterly direction.
- **Proximity to the Equator** – Provides an extra boost for payloads.
- **Safety Considerations** – Reduces risks due to fewer maritime and airline routes.
- **Other Factors** – Features uninhabited land and proximity to the sea for safer launches.

Existing Launch Pads in India: ISRO currently operates two launch pads at Sriharikota:

- **First Launch Pad** – Supports Polar Satellite Launch Vehicle (PSLV) and Small Satellite Launch Vehicle (SSLV).
- **Second Launch Pad** – Primarily used for Geosynchronous Satellite Launch Vehicle (GSLV) & LVM3, also serving as a backup for PSLV.

5. ISRO'S CROPS EXPERIMENT

News: ISRO has achieved a remarkable feat by successfully germinating cowpea seeds in microgravity conditions during its PSLV-C60 POEM-4 mission.

- The **Compact Research Module for Orbital Plant Studies (CROPS) payload, developed by the Vikram Sarabhai Space Centre (VSSC) in** Thiruvananthapuram, was **used in ISRO's CROPS experiment.**
- This payload was among the 24 carried aboard the PSLV-C60 mission, which was launched on 30th December 2024. The **fourth stage of PSLV (POEM-4)** served as a platform for hosting these 24 scientific experiments.
- **Objective-** CROPS is a multi-phase initiative aimed at developing sustainable agricultural practices in space.

Key Features

- The CROPS payload is an automated system designed to study seed germination and plant survival in microgravity**.**
  - Microgravity refers to conditions where gravity is minimal or where objects experience free fall, such as inside the International Space Station (ISS).
- The experiment **involves eight cowpea seeds** housed in a controlled, enclosed environment with regulated temperature and advanced monitoring systems to track plant growth.
  - Monitoring tools include high-definition cameras, sensors for oxygen and carbon dioxide levels, humidity detectors, temperature monitors, and soil moisture measurement devices.

6. TECHNOLOGY ADOPTION FUND (TAF)

News: Recently, the Indian National Space Promotion and Authorization Centre (IN-SPACe) has launched a new fund called Technology Adoption Fund.

About Technology Adoption Fund

- It consists of a corpus of Rs 500 crore to support the growth of India's space startups.
- This fund aims to accelerate the development of indigenous space technology, reducing reliance on imported solutions.
- The fund will **offer financial support of up to 60% of the project cost for startups and MSMEs,** and **40% for larger industries**, with a **maximum funding cap of Rs 25 Crores per project.**
- It is also **open to all eligible Non-Government Entities (NGEs)/ companies** that are ready to demonstrate the commercial potential of their innovations.
- It will also **provide partial funding to NGEs**. In addition to financial support, the initiative will provide technical guidance and mentoring opportunities, which will help companies navigate challenges during the product development phase.
- The fund will also **support the transition of early-stage space technologies** developed by Indian companies into commercially viable products.
- This support will enable companies to refine their technologies, enhance production processes, and meet market demands both within India and abroad.

7. SCRAMJET ENGINE

News: The Defence Research and Development Organisation (DRDO) has successfully conducted a ground test of an Active Cooled Scramjet Combustor for 120 seconds for the first time.

About Scramjet Engine

- A Scramjet engine (Supersonic Combustion Ramjet) is an **improved version of the Ramjet**, designed to operate at extremely high speeds.
  - A **ramjet is an air-breathing jet engine** that relies on the **vehicle's forward motion** to compress incoming air for combustion, eliminating the need for a rotating compressor
- It works by using supersonic airflow to generate thrust and functions at hypersonic speeds (**Mach 5+)**
- **Key features:**
  - **Air-Breathing Engine:** Unlike traditional rocket engines, Scramjets use atmospheric oxygen for combustion, eliminating the need to carry heavy oxygen tanks.
  - **No Moving Parts:** Scramjets rely on supersonic airflow, making them highly efficient for sustained high-speed travel.
- **Significance:**
  - Next-generation hypersonic missiles with unmatched speed and accuracy.
  - Faster air travel, potentially reducing flight times drastically.
  - Low-cost satellite launches, making space access more affordable.

8. RECLASSIFICATION OF MAJOR MINERALS

News: The Ministry of Mines reclassified Barytes, Feldspar, Mica, and Quartz as major minerals from their previous minor mineral status

Distinction Between Major and Minor Minerals in India

- The classification of minerals is based on their economic significance, regulatory framework, and industrial applications, as defined under the **Mines and Minerals (Development and Regulation) Act, 1957 (MMDR Act).**
- **Major Minerals**- Minerals of high economic importance that play a crucial role in industrial and infrastructure development. Governed by both central and state authorities, with the **central government overseeing mining through the Indian Bureau of Mines (IBM).**
- **Minor Minerals**- Less valuable minerals primarily used in construction, local industries, and minor commercial purposes.Minor mineral **administration and regulation fall to state governments.**

Key Minerals & Their Strategic Importance

Mineral	Previous Use	Strategic Relevance After Reclassification
Barytes	Used in oil drilling	Nuclear shielding, medical industry, space technology

Feldspar	Ceramics, glass, paints	Battery-grade materials, advanced glass coatings
Mica	Electrical insulation, cosmetics	Defense, aerospace, satellites
Quartz	Industrial applications	Semiconductors, solar PV, fiber optics

9. SOAPSTONE

News: The Uttarakhand High Court recently criticized authorities over the lack of regulation in soapstone mining in Bageshwar, a district that currently has over 160 operational mines.

About Soapstone

- It is also known as **Steatite**.
- It is a metamorphic rock composed mainly of **talc**, a naturally occurring mineral.
- It is widely used in construction and design for countertops, sinks, hearths, and sculptures.
- The mineral composition of soapstone varies depending on its source and may include micas, chlorite, amphiboles, quartz, magnesite, and carbonates.
- **Formation of Soapstone**
  - Soapstone **typically forms at convergent plate boundaries**, where large sections of the Earth's crust experience heat and pressure.
  - In such environments, peridotites, dunites, and serpentinites undergo metamorphism to form soapstone.
- **Properties**: It is a relatively soft, very dense, highly heat-resistant material.
- **Major producing countries**: China, India, Brazil, USA, and Finland.
- **India's major reserves**: According to the Indian Bureau of Mines, the largest soapstone deposits are found in **Rajasthan (57%)** and **Uttarakhand (25%).**
- **Applications:**
  - Powdered soapstone, often mixed with cornstarch, is used in baby powder.
  - Used as a thickening agent and lubricant.
  - A key ingredient in ceramics, paint, roofing materials, and many cosmetics.
  - Talc, derived from soapstone, is widely used in cosmetics, pharmaceuticals, and various industries

10. CIVIL LIABILITY FOR NUCLEAR DAMAGES ACT (CLNDA)

News: Union government's recent announcement that it would amend the Civil Liability for Nuclear Damages Act (CLNDA), 2010 and Atomic Energy Act 1962. It is likely to enthuse American & French nuclear power companies, whose projects have been deadlocked due to legal concerns for more than 15 years.

About Civil Liability for Nuclear Damages Act (CLNDA)

- The CLNDA was adopted by Parliament in 2010.
- It is the legal foundation that influences India's response to nuclear incidents.

- It is based on the international principles of civil nuclear liability laid down in the **Vienna Convention, Paris Convention & Brussels Supplementary Convention**.
- It created a **mechanism for compensating victims from damage caused by a nuclear accident**, allocating liability & specifying procedures for compensation.
- **Features**:
  - The CLNDA provides for **strict & no-fault liability on the operator of the nuclear plant**, where it will be held liable for damage regardless of any fault on its part.
  - This Act establishes the operator's liability for nuclear catastrophes up to **1,500 crore,** which requires insurance or financial security.
  - In case the damage **claims exceed ₹1,500 crore, the CLNDA expects the government to step in.**
  - The Act has limited the government liability amount to the rupee equivalent of 300 million Special Drawing Rights (SDRs) or about ₹2,100 to ₹2,300 crore.
  - In addition to establishing a timeline for compensation claims, the act authorises the Atomic Energy Regulatory Board to **report incidents within 15 days**.
  - In addition, the act establishes a **Nuclear Damage Claims Commission** to facilitate equitable compensation and conflict resolution.

11. AI ACTION SUMMIT 2025

News: The AI Action Summit 2025, held in Paris brought together representatives from 60 nations to discuss the future of artificial intelligence

Key Highlights

- **Host & Leadership**: Paris, France; co-chaired by India and France.
- **Primary Focus**: Advancing inclusive and sustainable AI development.
- **Participation**: 60 nations signed the joint statement, while the **United States and the United Kingdom did not participate as signatories**.

Main Provisions of the Joint Statement:

- Ensuring AI is accessible, trustworthy, and safe.
- Utilizing AI for industrial advancement and labor market growth.
- Encouraging international collaboration in AI innovation.
- Strengthening AI capabilities in developing nations.
- Upholding AI principles that are human-centric, ethical, secure, and reliable.

12. CHINA'S 'ARTIFICIAL SUN' EAST

News: Recently China's 'artificial sun', the Experimental Advanced Superconducting Tokamak (EAST) reactor, sustained plasma for 1,000 seconds, breaking its 2023 record of 403 seconds.

About Experimental Advanced Superconducting Tokamak (EAST) reactor

- It is a **fusion research device** located at the Institute of Plasma Physics of the Chinese Academy of Sciences (ASIPP) in Hefei, China.

- It became operational in 2006.
- Its purpose is to study and develop nuclear fusion technology by replicating the process that powers the Sun.
- It **aims to achieve sustained high-temperature plasma confinement**, advancing research for future clean and limitless energy sources.
- It serves as a testing platform for materials, superconducting technology, and plasma control methods essential for next-generation fusion reactors like **International Thermonuclear Experimental Reactor (ITER).**

About International Thermonuclear Experimental Reactor (ITER)

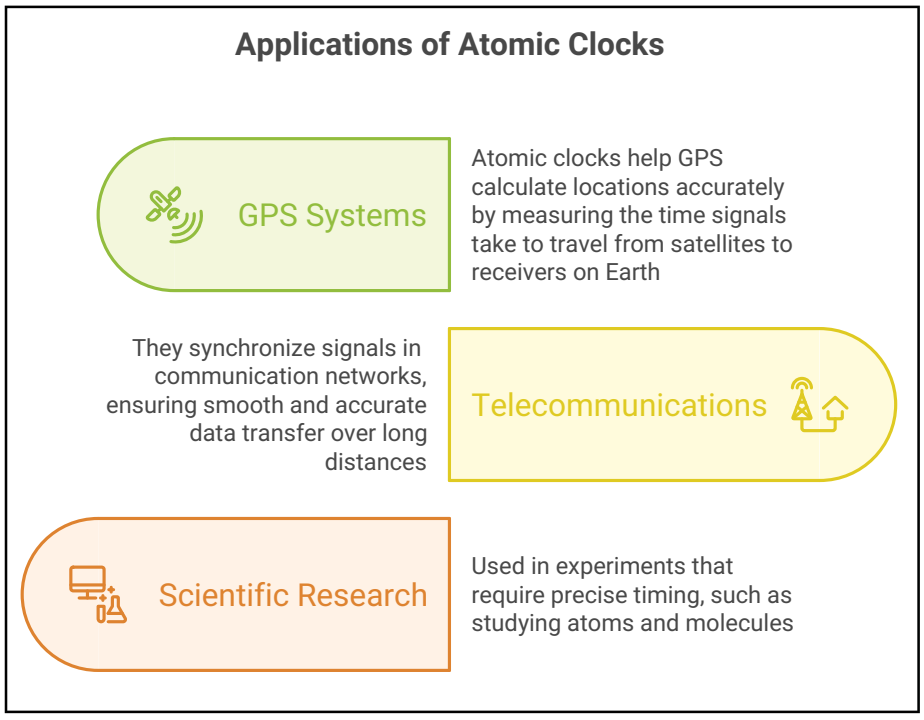
- ITER is an international collaboration involving China, Europe, Japan, India, South Korea, Russia, and the United States.
- **India formally joined ITER in 2005**.
- It is being built in France to demonstrate the feasibility of fusion as a sustainable energy source.

13. ATOMIC CLOCK

News: Quantum-based atomic clock has been developed in United Kingdom.

About Atomic Clock

- An atomic clock is a highly precise timekeeping device that **relies on the resonance frequencies of atoms, typically cesium or rubidium,** to measure time with exceptional accuracy.
- The newly developed quantum-based atomic clock is said to lose **less than one second over billions of years**, enabling scientists to measure time at an unprecedented scale.



14. GARBHINI DRISTHI

News: India's commitment to cutting-edge biomedical research and innovation took a significant leap forward with the dedication of the nation's first Ferret Research Facility, the launch of the GARBH-INi-DRISHTI data repository, and the execution of a key technology transfer agreement.

About GARBH-INi-DRISHTI (initiative of Department of Biotechnology (DBT)

- It is a data dashboard that provides a comprehensive overview of **one of South Asia's largest pregnancy cohort datasets.**
- This groundbreaking platform, **developed under the GARBH-INi program**, provides access to an unprecedented wealth of clinical data, images, and biospecimens collected from over 12,000 pregnant women, newborns, and postpartum mothers.
- It will empower researchers worldwide to conduct transformative research aimed at improving maternal and neonatal health outcomes.
- It serves as a gateway for researchers to explore the depth and diversity of the data, enabling a deeper understanding of the cohort.

GARBH-INi-Program:

- It stands for Group for Advanced Research on Birth Outcomes – DBT India Initiative.
- It **promotes Maternal & Child Health & develops prediction tools for preterm birth**.
- It is an initiative under the **Department of Biotechnology** of Union Ministry of Science & Technology as a collaborative interdisciplinary programme.
- This program is led by Translational Health Science & Technology Institute (THSTI).
- It is **part of the Atal Jai Anusandhan Biotech Mission** – Undertaking Nationally Relevant Technology Innovation (UNaTI).

To the Point	
Terms/Initiatives in news	
Methylcobalamin	**Context-** FSSAI clarified the guidelines for using Methylcobalamin in health supplements, medical products, and nutraceuticals under specific conditions. **About Methylcobalamin** • It is an **active form of Vitamin B12**, essential for cell multiplication, blood formation, and protein synthesis. ▪ Vitamin B12 is a water-soluble vitamin crucial for DNA synthesis, red blood cell (RBC) production, and neurological function. ▪ Other forms of Vitamin B12 include **cyanocobalamin** and **hydroxocobalamin**. • **Sources**- meat, fish, milk and dairy products. • **Uses**- Pain relief in diabetic neuropathy, Treatment of anemia, management of Alzheimer's disease

Bharat Tech Triumph Program	**Context-** The Bharat Tech Triumph Program has been introduced to promote digital and online gaming in India. **About the Bharat Tech Triumph Program**: • **Launched by**: Interactive Entertainment and Innovation Council (IEIC) in collaboration with the Ministry of Information and Broadcasting (MIB). • **Objective**: To recognize and present India's gaming talent on a global platform. • **Key Focus**: The program aims to provide Indian innovators with an opportunity to showcase their skills internationally, strengthening India's footprint in the global gaming industry.
Pink Fire Retardant (Phos-Chek)	**Context-** Los Angeles Deploys Pink Fire Retardant to Battle Wildfires. **About Pink Fire Retardant (Phos-Chek)** • Fire retardants are chemical mixtures designed to **slow or suppress the spread of fires**. • **Phos-Chek**, produced by Perimeter Solutions, is the most widely used fire retardant globally. • It primarily consists of an **ammonium phosphate-based slurry**. ▪ Typically formulated with salts like ammonium polyphosphate, it remains effective for longer periods as it does not evaporate as quickly as water.
MATSYA 6000	**Context**: India's first manned submersible, Matsya 6000, is expected to carry 3 people to a depth of 6,000 metres in the ocean by 2026, Union Minister of State for Science and Technology and Earth Sciences said recently. **About Matsya 6000** • Matsya 6000 is India's deep-sea submersible designed for ocean exploration, particularly for deep-sea mining & biodiversity studies. • **Developed by** the National Institute of Ocean Technology (NIOT) under Samudrayaan Mission, it is capable of diving to a depth of 6,000 meters in the ocean.
Einstein Ring	**Context-** The European Space Agency's (ESA) Euclid space telescope has spotted a rare ring of light, called an Einstein ring, around a galaxy named NGC 6505. **About Einstein Ring** An Einstein ring is a special type of gravitational lensing, where light from a distant object (like a galaxy or quasar) bends and magnifies as it passes around a massive object (such as another galaxy or black hole) between the source and the observer.

	Significance: ▪ **Mass Distribution**: The ring's shape and size help scientists determine the mass of the lensing object, including dark matter, which is invisible. ▪ **Distant Objects**: They magnify light from faraway objects, helping astronomers study distant galaxies and the expansion of the universe

Mission in news	
Mission SCOT	**Context-** The Prime Minister has congratulated Digantara for the successful launch of Mission SCOT (Space Camera for Object Tracking). **About Mission SCOT** • It is the **world's first commercial satellite** for surveillance of Resident Space Objects (as small as 5cm) orbiting the Earth to ensure safer space operations. . • It aims to improve space safety, optimise traffic management and strengthen national security initiatives. • The SCOT satellite has been launched onboard **SpaceX Transporter-12 mission**. • SCOT will be **deployed in a sun-synchronous orbit**. This will enable it to track objects in Low Earth Orbit (LEO) with greater efficiency as compared to the existing sensors.
PUNCH mission	**Context:** NASA is gearing up for a new and first-of-its-kind solar mission called PUNCH mission that will closely observe the solar atmosphere. **About PUNCH Mission** • The Polarimetry to Unify the Corona and Heliosphere (PUNCH) mission will be launched by **SpaceX.** • **Time Period:** The expected mission life is **two years**. • It is the first time that a solar mission has been specifically designed to **make use of the polarisation of light to measure the corona and solar wind, that too, in 3D**. • It will provide scientists with new information which could lead to more accurate predictions about the arrival of space weather events on Earth and impact on humanity's robotic explorers in space. • It will **measure polarised light using polarising filters**, enabling scientists to look into the inner solar system.
GAIA Mission	**Context-** The European Space Agency (ESA) has officially decommissioned its Global Astrometric Interferometer for Astrophysics (GAIA) mission.

	About GAIA Mission • It aimed to create the largest and most precise **3D map of the Milky Way** by surveying about 1% of its 100 billion stars. • It was launched in 2013. • **Position**: Gaia orbits the Sun at **Lagrange Point 2,** about 1.5 million kilometers (930,000 miles) from Earth.