Today's Prelims Topics

Suriname

Context

India sent the final batch of passion **fruit processing machinery to Suriname** under the SEEDS initiative.

About Suriname

- **Location:** Suriname is one of the smallest countries located on the northern coast of South America.
- **Capital:** Paramaribo, situated on the Suriname River; designated as a UNESCO World Heritage Site in 2002.
- **Borders:**
  - North: Atlantic Ocean
  - East: French Guiana
  - South: Brazil
  - West: Guyana
- **Colonial History:** Formerly known as Dutch Guiana, it was a plantation colony of the Netherlands and gained independence in 1975.
- **Drainage System:** Major rivers include the Corantyne, Coppename, Suriname, and Marowijne, all flowing northward into the Atlantic Ocean.
- **Ethnic Composition:** South Asians, primarily descendants of Indian contract laborers, are the largest ethnic group, forming over one-fourth of the population.

About SEEDS initiative

(SEEDS = **Supply of Equipment for Efficient Development of SMEs**)

The **SEEDS initiative** is a development cooperation program launched by the **Ministry of External Affairs (MEA), Government of India**. It aims to promote sustainable economic growth and industrial development in **partner countries**, particularly in the **Global South**, by supporting their **Small and Medium Enterprises (SMEs)**.

Key Features of the SEEDS Initiative

- **Objective:** To strengthen bilateral relations by supplying **critical machinery and equipment** that enhance productivity and income generation in recipient countries.
- **Target Beneficiaries:** Small and Medium Enterprises (SMEs), farmers, and local industries in developing countries.
- **Nature of Support:** Donation or supply of equipment such as processing machinery, tools, and technologies that are **cost-effective and efficiency-enhancing**.
- **Strategic Focus:**
  - Encourages **South-South cooperation**.
  - Promotes **local capacity-building** and **self-reliance**.
  - Boosts **India's diplomatic and development partnerships** through practical support.
- **Recent Example:** In 2024–25, under this initiative, **India sent two batches of machinery for passion fruit processing to Suriname**, aimed at improving the country's agro-industry and SME sector.

Significance

- Strengthens **India's role as a development partner**.
- Enhances **economic diplomacy** and **people-to-people ties**.
- Supports the **UN Sustainable Development Goals (SDGs)**, especially those related to **economic growth**, **industry innovation**, and **partnerships**.

In essence, SEEDS is part of India's broader vision to act as a **reliable partner for inclusive development**, especially among nations of the **Global South**.

Source: TheHindu

Cyprus

Context

Recently, Prime Minister Narendra Modi visited Cyprus.

About Cyprus

- **Location:** Eastern Mediterranean Sea
- An European Union (EU) member, despite being geographically in Asia.
- **Capital:** Nicosia (Lefkosia in the south, Lefkoşa in the north).
- **Bordering Nations (Maritime):** Turkey, Syria, Lebanon, Israel (no land borders).
- **Geography:**
    - **3rd largest Mediterranean island** (after Sicily, Sardinia).
    - Kyrenia Mountains (north), Troodos Mountains (south), Mesaoria Plain (center).
    - **Highest peak:** Mount Olympus (1,951 m).
    - Mediterranean climate; rainfall crucial for agriculture.

Importance to India

- **Strategic Support:** Backs India's bid for UN Security Council seat & Nuclear Suppliers Group (NSG) membership.
- **Geopolitical Counterbalance:** Acts as a diplomatic counter to Turkey's growing ties with Pakistan.
- **IMEC Corridor Role:** Positioned along India–Middle East–Europe trade route.
- **EU Influence:** Cyprus will hold EU Council Presidency in 2026 which will be a key for India–EU relations.

Source: IndianExpress

DNA Analysis to Identify Plane Crash Victims

Context

DNA analysis is being used to identify victims of the recent Air India plane crash in Ahmedabad.

DNA Identification Process

1. Collection & Storage of Samples:

- DNA starts degrading after death; hence, **quick collection** is crucial.
- Samples must be collected **as soon as possible** and stored in a **cool, dry environment** or preserved in **95% ethanol**.
- **DNA survives better in cold and dry conditions**.
- **Soft tissues degrade fast**, so bones and teeth are preferred as they **resist decomposition**.
- Samples from family members (parents, children, siblings) are also collected for **reference comparison**.

2. Challenges in Sample Collection:

- In **large-scale disasters**, recovery may take **weeks or months** (e.g., 9/11 took 10 months to collect samples).
- The **extent of the crash** affects how easily samples can be recovered.

3. Reference Samples:

- Collected from **biological relatives** (parents, siblings, children).
- These share **50% or more of DNA** with the deceased and help in matching.

4. Methods of DNA Analysis:

a. Short Tandem Repeat (STR) Analysis:

- Analyzes short repeating sequences in nuclear DNA.
- Used for **high-confidence family identification**.
- Requires **non-degraded nuclear DNA**.

b. Mitochondrial DNA (mtDNA) Analysis:

- Used when **nuclear DNA is degraded**.
- mtDNA is **inherited from the mother** and found in **multiple copies per cell**, making it easier to extract.
- Helps match with **maternal relatives** (mother, maternal grandmother, siblings).

c. Y Chromosome Analysis:

- Used to match **male victims** with **paternal relatives** (father, paternal uncle, cousins).
- Analyzes markers on the **Y chromosome**, which passes from father to son.

d. Single Nucleotide Polymorphisms (SNPs) Analysis:

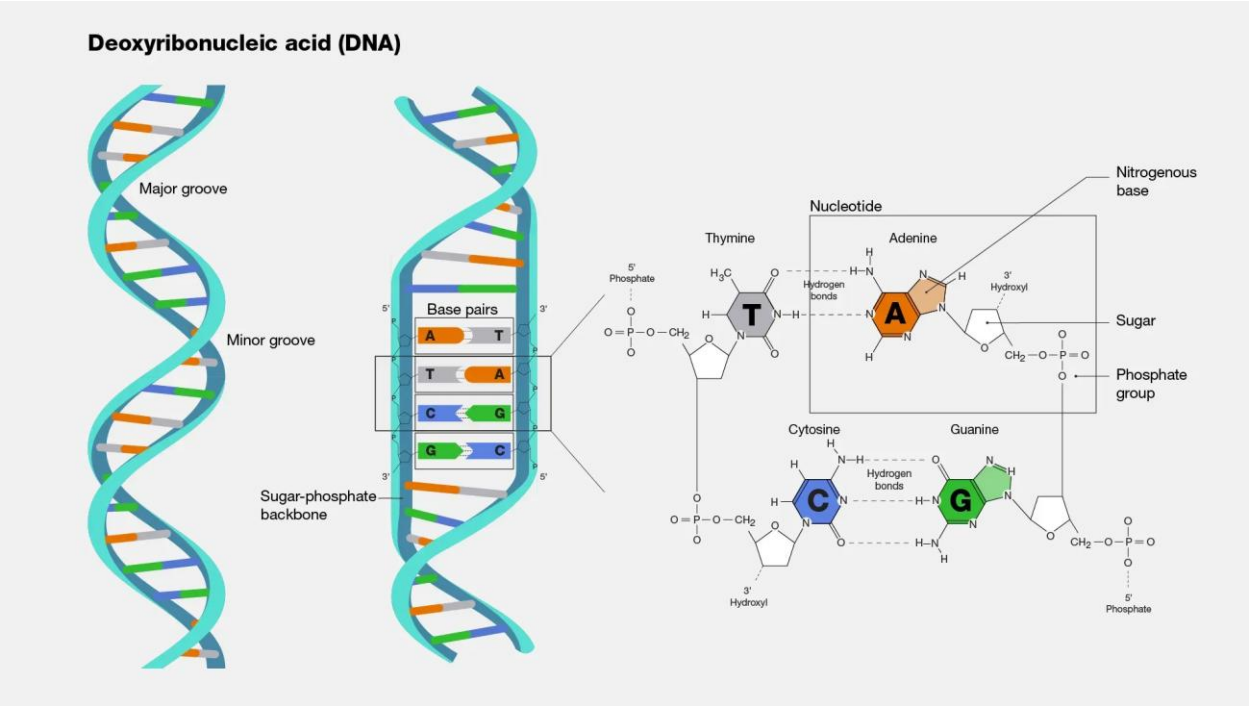
- Used when DNA is **highly degraded**.
- Focuses on specific **single-letter changes in DNA** (A, T, C, G).
- Less effective than STR but useful when limited DNA is available.

5. Personal Belongings for DNA:

- DNA may also be extracted from items like a **toothbrush, hairbrush**, etc., for individual profiling when body samples are insufficient.

DNA analysis, especially STR, mtDNA, and SNPs, is critical for identifying victims in air crashes, particularly when physical recognition is impossible.

About DNA

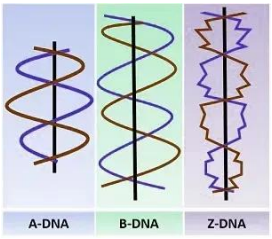


- Deoxyribonucleic Acid; discovered by Friedrich Miescher in the 1860s; double helix structure revealed by Watson, Crick, Franklin & Wilkins in 1953.

Structure

- A double-stranded helix with alternating sugar (deoxyribose) & phosphate backbone.
- Four nitrogenous bases: Adenine (A), Thymine (T), Cytosine (C), Guanine (G); A–T & C–G pairing.
- Human DNA has ~3 billion base pairs, with over 99% sequence similarity across individuals.
- Present primarily in the cell nucleus (nuclear DNA; packed in chromosomes – humans have 23 pairs = 46).
- Also present in mitochondria (mitochondrial DNA), it is **maternally inherited**.

Types of DNA Helices



- **B-DNA**: Common right-handed form.
- **A-DNA**: Right-handed, shorter & broader.
- **Z-DNA**: Left-handed zigzag form, less common.

Functions

- Stores genetic information for growth, development, function & reproduction.
- Codes for proteins via transcription → translation pathway.
- During **transcription**, DNA is copied into messenger RNA (mRNA).
- During **translation**, mRNA is read to synthesize proteins.
- **Replication** is a semi-conservative process where each new DNA molecule has one old and one new strand.
- DNA fingerprinting is used in **forensics, paternity tests, and disaster victim identification**.
- DNA plays a crucial role in **protein synthesis**, inheritance, and **evolutionary studies**.

Source: IndianExpress

Cash Plus Model

Context

Rajasthan released the report of Cash Plus model.

What is the Cash Plus Model?

- A **state-led pilot project in Rajasthan**, launched in 2020.
- Combines **Direct Benefit Transfers (DBT)** with **Social and Behaviour Change Communication (SBCC)** to improve maternal and child nutrition.
- Augments the existing **Pradhan Mantri Matru Vandana Yojana (PMMVY)**.
- Targeted in five tribal districts—Baran, Banswara, Dungarpur, Pratapgarh, and Udaipur.
- Provides **cash support**, **home visits**, **nutrition counselling**, and **group sessions** for **pregnant and lactating women**.

Note*: Includes support for **second-time mothers** as well.

Key Highlights of the Report

- A new **report card** shows significant success of the model:
    - **49% rise in early breastfeeding** (now 90% of newborns).
    - **44% of women** more receptive to home-based counselling.
    - **49% improvement in dietary diversity**.
    - **54% more women** using cash for nutrition.
- Over **3.3 million women** benefited since scale-up in 2022.
- The model is already **driving positive changes** in diet, registration, check-ups, and community health engagement.
- It is being seen as a **successful scalable model** for other Indian states.

Source: TheHindu

Special economic zones rules have been relaxed

Context

To support India's semiconductor ambitions, the Ministry of Commerce and Industry **amended the SEZ Rules, 2006.**

What Were the Changes?

- **Rule 5**: Reduction in Minimum Land Area For Semiconductor/Electronic SEZs → **50 hectares** to **10 hectares.**
- **Rule 7: Relaxation of Encumbrance-Free Land Requirement**
- **Rule 18: Permission for Domestic Sales** → Sell only for export to the domestic **market** after paying applicable duties.

What are Special Economic Zones (SEZs)?

- SEZs are specifically delineated, duty-free enclaves treated as foreign territory for trade and customs purposes, set up to boost exports, attract investment, and create jobs.
- **Key Features:**
  - Exemption from customs duty, GST, and other taxes
  - 100% FDI allowed in manufacturing
  - Single-window clearance and liberal regulatory regime
  - Units must export a minimum portion of production

Currently, India has **276 operational SEZs** with total employment of 3.19 million people as of March 31, 2024. Goods exports from Indian SEZs reached US$143.34 billion till January 31, 2025.

History of SEZs in India

Year	Development
1965	First Export Processing Zone (EPZ) set up in Kandla, Gujarat — Asia's first.
2000	SEZ Policy announced as part of EXIM Policy to enhance EPZ framework.
2005	**SEZ Act, 2005** enacted to provide a legal framework and incentives. Came into effect in 2006.
2018	Baba Kalyani Committee recommended reforms to make SEZs more WTO-compliant and employment-friendly.
2022	Budget proposed replacing SEZ Act with new **Development of Enterprise and Service Hubs (DESH)** framework to align with WTO norms.

Fact

➔ According to the Semiconductor Industry Association, **China accounted for about 35% of all semiconductors** manufactured in the world in 2021.

Source: The Hindu

News in Shorts

Schwarzman Scholars programme

News? India needs a programme similar to the **Schwarzman Scholars Programme of China**.

About Schwarzman Scholars Programme

- **Launched in:** 2016
  - Inspired by the **Rhodes Scholarship** (Oxford, 1902).
- **Mission:** To develop future global leaders by providing a deep understanding of China's role in the world and fostering cross-cultural leadership skills.
  - Fellows study for a **one-year Master's in Global Affairs**.
  - Focuses on **geopolitics, leadership**, and **global affairs**.
- **Why Such Initiative Needed?**
  - **Strategic Global Influence:** Build global leaders who understand and engage with India's rise.
  - **Correcting Perception Asymmetry:** Challenge outdated Western views; present India as modern power.
  - **Bridging the Institutional Gap:** Create flagship academic platform with global reach and credibility.
  - **Training Global and Domestic Leaders:** Develop leadership talent rooted in Indian values and global awareness.
  - **Enhancing India's Soft Power:** Project India's culture, democracy, and innovation through global fellowships.
  - **Narrative Assertion in a Multipolar World:** Shape global narratives by telling India's story on India's terms.

Source: TheHindu

Terms in News

Operation	Event
Operation Spider's Web	Refers to Ukraine's long-range drone strikes inside Russia during the conflict.
Operation Desert Sabre	Final ground offensive by U.S.-led coalition to liberate Kuwait from Iraq.
Operation Overlord	Refers to the Allied D-Day invasion of Normandy during WWII (1944).

Editorial Summary

AI And Biomanufacturing

Context

- India's BioE3 Policy and IndiaAI Mission signal a push to fuse artificial-intelligence tools with the nation's proven strengths in biomanufacturing.
- AI can turn India from the "pharmacy of the world" into a design-and-discovery powerhouse—but only if regulation, data practice and skills keep pace.

Why AI Matters in Biomanufacturing

Area	AI-Driven Pay-off	Indian Examples
Process optimisation	Predicts deviations, tunes parameters in real time → higher yields, fewer failed batches	Biocon uses AI analytics to fine-tune fermentation runs
Digital twins	Virtual replicas let engineers test changes without halting production → faster scale-up	Emerging "Bio-AI Hubs" in the BioE3 blueprint
Drug discovery & design	In-silico screening of millions of compounds → shorter R&D cycles, lower cost	Strand Life Sciences' genomics AI, Wipro molecular-design tools
Quality & compliance	Continuous data streams + anomaly detection → tighter GMP compliance, quicker audits	Tata Consultancy Services' AI dashboards for clinical-trial quality
Supply-chain resilience	Demand forecasting & predictive maintenance → fewer shortages, steadier exports	AI-enabled logistics pilots for vaccine cold-chains

Roadblocks and Risks

- **Fragmented, legacy regulation:** 2005-era drug rules don't cover self-learning control systems or "software as a manufacturing step."
- **Data-governance gaps:** Diverse, messy datasets risk bias; Digital Personal Data Protection Act 2023 lacks sector-specific guidance for bio-AI.
- **Credibility & safety assurance:** No Indian equivalent of the FDA's "Predetermined Change-Control Plans" or EU "risk tiers."
- **Talent & infrastructure divide:** AI/biotech skills clustered in metros; Tier-II plants lack sensors, secure cloud, high-quality power.
- **IP & inventorship ambiguity:** AI-generated molecules challenge current patent norms; ownership of training data unclear.
- **Cyber-biosecurity threats:** Networked equipment widens attack surface for data theft or process sabotage.

What India Should Do — Action Agenda

- **Adopt Risk-Based, Flexible Regulation:** Develop new guidelines under the Central Drugs Standard Control Organisation (CDSCO) for AI in biomanufacturing.
    - Classify AI tools based on risk, similar to the U.S. Food and Drug Administration (FDA) and European Union (EU) rules.

    - Make it mandatory for developers to clearly define how the AI will be used and ensure real-time monitoring of its performance.
- **Set Clear Data Standards and Audit Systems:** The Bureau of Indian Standards (BIS) should release standards for biomanufacturing data — covering diversity, data sources, and bias control.
    - Require companies to maintain secure and tamper-proof records of how AI models are updated over time.
- **Create Testing Grounds and Innovation Zones:** Speed up the creation of "Biofoundries" under the BioE3 Policy as experimental zones for AI in manufacturing.
    - Establish government-funded centres to test and approve AI models used in drug production.
- **Build Skilled Workforce and Expand Beyond Cities:** Introduce AI and biotechnology courses in Indian Institutes of Technology (IITs) and National Institutes of Pharmaceutical Education and Research (NIPERs).
    - Offer funding to train workers and set up infrastructure in smaller cities and towns.
    - Provide subsidies for buying smart sensors and internet-connected systems for rural or semi-urban biotech units.
- **Clarify Rules on AI-Driven Innovations and Data Sharing:** Update the Patents Act to clearly define who owns inventions made by AI systems.
    - Create easy-to-use legal templates for companies and research labs to share genetic and production data fairly and securely.
- **Partner with Global Agencies to Build Trust:** Join international forums like the Organisation for Economic Co-operation and Development (OECD) and the International Council for Harmonisation (ICH) to align on AI safety rules.
    - Sign agreements with other countries to recognise each other's AI-approved manufacturing practices.

Source: The Hindu AI And biomanufacturing

Reimagining a green movement of goods

Context

- India's logistics sector, expected to nearly double to **$428 billion by 2033**, plays a crucial role in powering economic growth and trade.
    - However, it also contributes significantly to **greenhouse gas emissions** and **diesel consumption**.
    - As India pushes towards its **Net Zero goals** and the vision of **Viksit Bharat 2047**, transitioning to **green and efficient logistics** is not just desirable—it is essential.

Environmental Concerns Related to Logistic Sector

- **Overdependence on Road Transport:** Roads carry over 60% of freight, causing higher emissions and road congestion.
    - The sector accounts for **13.5% of India's GHG emissions**; trucks alone emit over **one-third of transport CO_2.**
- **Excessive Diesel Consumption:** Accounts for **nearly 40% of India's total diesel use**.
    - Diesel combustion releases **particulate matter (PM), nitrogen oxides (NOx),** and **sulphur dioxide (SO_2)** — harmful air pollutants.
- **Urban Congestion and Noise Pollution:** Inefficient last-mile delivery and unregulated freight movement in cities cause traffic congestion, wasted fuel, and noise pollution.
- **Carbon-Intensive Infrastructure:** Logistics infrastructure like warehouses and cold chains often rely on non-renewable energy sources.
    - Lack of energy-efficient designs leads to high carbon footprints.

Government Schemes to Boost the Logistics Sector

Scheme/Initiative	Objective
PM Gati Shakti National Master Plan (2021)	Integrated infrastructure development for seamless multi-modal logistics across 7 engines (rail, road, air, etc.).
National Logistics Policy (2022)	Reduce logistics cost from 13-14% of GDP to 8-10%; improve efficiency and sustainability.
Unified Logistics Interface Platform (ULIP)	Digital integration of various stakeholders to streamline documentation and real-time tracking.
Sagarmala Project	Port-led development to reduce logistic costs and transit time through coastal and inland waterways.
Bharatmala Pariyojana	Development of highways and economic corridors to improve road connectivity for freight movement.
Freight Smart Cities (MoRTH Initiative)	Promote city-level logistics planning for congestion-free, green, and efficient freight systems.
Dedicated Freight Corridors (DFCs)	Decongest railways by shifting goods transport from road to energy-efficient rail corridors.

What Can Be Done to Improve the Logistics Sector

- **Promote Green Logistics Practices:** Incentivise adoption of **Electric Vehicles (EVs)** and **LNG trucks** for urban and intercity freight.
- **Expand Rail and Waterway Freight:** Strengthen **Dedicated Freight Corridors** and **inland water transport** to reduce road load.
- **Adopt Smart Planning Tools:** Use **AI and data analytics** to optimise routes, reduce fuel usage, and improve load efficiency.
- **Invest in Sustainable Infrastructure:** Develop **green warehouses** with solar energy, LED lighting, and rainwater harvesting systems.

- **Skilling and Formalisation:** Support MSMEs and transporters in adopting digital tools and eco-friendly practices.
- **Policy Support for Clean Energy Use:** Provide **subsidies or tax incentives** for using alternative fuels and EV charging infrastructure.
- **Strengthen Urban Freight Management:** Promote **Freight Smart Cities** with dedicated freight lanes, time-slotting, and low-emission zones.

Source: **The Hindu: Reimagining a green movement of goods**