Today's Prelims Topics

Adult Neurogenesis

Context

A 2025 study in Science by Karolinska Institutet, Stockholm has provided fresh evidence of adult neurogenesis.

What is Neurogenesis?

- It is the process by which **new neurons (nerve cells)** are formed in the brain.
- It mainly occurs in the **hippocampus** (dentate gyrus), the region responsible for **memory, learning, and emotional regulation**.

What is the New Finding?

- The new study has provided strong evidence that **neurogenesis continues in the adult human brain**, specifically in the **hippocampus**.
- This overturns the long-held belief that **new neurons stop forming after childhood.**
- **Significance:**
    - Establishes adult neurogenesis as a conserved feature in mammals.
    - Explains how the adult brain maintains flexibility in learning and memory.
    - Offers hope for regenerative therapies to treat neurodegenerative diseases such as Alzheimer's, Parkinson's, and dementia.

Source: The Hindu

Protein Language Model

Context

A team of researchers at the Massachusetts Institute of Technology (MIT), USA has developed a method to look inside the "black box" of protein language models (pLMs).

What is a Protein Language Model (pLM)?

- It is a type of **large language model (LLM)** trained not on human languages, but on **protein sequences**.
- Just like normal LLMs predict the *next word* in a sentence, pLMs predict the **next amino acid** in a sequence.

> - Amino acids (20 types in total) are the building blocks of proteins, and their sequence determines a protein's 3D shape and function.
> - **Types:**
> - **Essential amino acids (9):** Cannot be made by the body → must come from diet (e.g., leucine, lysine).
> - **Non-essential amino acids (11):** Can be synthesized in the body (e.g., alanine, glutamine).

- **Why useful?**
  - pLMs can detect hidden patterns between sequence, structure, and function.
  - They can predict how a mutation (changing one amino acid) might alter the protein's shape or function.
  - This saves years of lab work (like X-ray crystallography or microscopy) and accelerates drug and vaccine design.

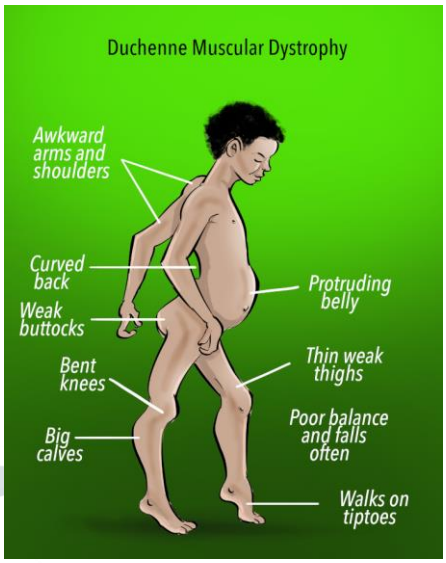
Source: Indian Express

Duchenne Muscular Dystrophy

Context

The Department of Empowerment of Persons with Disabilities (DEPwD), Ministry of Social Justice & Empowerment, observes World Duchenne Muscular Dystrophy Day every year on 7th September.

About Duchenne Muscular Dystrophy



- It is a rare genetic disorder that causes **progressive muscle weakness and degeneration** due to a lack of **dystrophin protein.**
- It is the **most common and severe form** of muscular dystrophy.
- **Cause:** Caused by mutations in the **DMD gene** on the **X chromosome**.
    - This gene codes for **dystrophin protein**, a protein essential for muscle strength and stability.
    - Since it is **X-linked recessive**, it **mainly affects boys** (females are usually carriers).
- **Cure:** No permanent cure yet.

Source: PIB

Engineering Export Promotion Council (EEPC)

Context

The President of India graced the Platinum Jubilee Celebrations of the Engineering Export Promotion Council (EEPC).

About EEPC

- It is a non-profit, non-commercial organisation that promotes India's engineering exports. **(Not a Statutory Body)**
- It was established in **1955 under the Ministry of Commerce, Government of India.**
- It is the largest Export Promotion Council in India.
- It helps MSMEs to raise their standard at par with international best practices & encourages them to integrate their business with the global value chain.

Related Fact

- India engineering export nation rose to USD 116.67 Billion (Apr 2024-March 2025).

Source: PIB

India-Israel Bilateral Investment Treaty

Context

Israel becomes first OECD country to sign Bilateral Investment Agreement with India.

What is a Bilateral Investment Treaty (BIT)?

- It is a **reciprocal agreement between two sovereign countries** that lays down the rules for **promotion and protection of investments** made by investors from one country in the territory of the other.
- India signed its **first BIT in 1994** (with the UK).
- In **2015**, India adopted a **new Model BIT**, replacing the 1993 version.

Key Features of India's Model BIT (2015)

- **Narrow Definition of Investment:** Investment must have characteristics like **long-term commitment, significant risk, and contribution to host country's economy**.
    - Prevents "treaty shopping" by speculative investors.
- **Fair and Equitable Treatment (FET):** Earlier BITs guaranteed broad FET → led to disputes.
    - 2015 Model narrows it down to **specific protections**, such as:
        - No denial of justice in legal proceedings.
        - No breach of due process.
        - No discrimination on grounds like nationality.
- **Investor–State Dispute Settlement (ISDS):** Arbitration is **not automatic**.
    - Investors must first **exhaust all domestic remedies** (courts in India) for at least **5 years**, before approaching international arbitration.
- **Expropriation:** Expropriation allowed only for **public purpose, in a non-discriminatory manner, and against fair compensation**.
    - Stronger protection of India's right to regulate in **public interest** (health, environment, financial stability, etc.).
- **Omission of MFN Clause:** No **Most Favoured Nation (MFN)** clause → prevents investors from claiming benefits from other treaties signed by India.

Kay Features of BIT

- Expected to **raise bilateral investments**, which currently stand at around USD 800 million.
- Provides **minimum standard of treatment** to investors while safeguarding the **regulatory rights of States**.
- Establishes an **arbitration-based mechanism** for resolving disputes, ensuring smoother trade and investment relations.

Glimpse of India–Israel Cooperation

- **Economic Relations:** Bilateral trade (excluding defence) stood at **USD 6.53 billion** in FY 2023–24.
- **Regional Cooperation:** Active participation in the **I2U2 Partnership** (India, Israel, UAE, US).
    - First Leaders' Summit held in **2022**.
- **Innovation & Technology:** Collaboration through the **India–Israel Industrial R&D and Innovation Fund (I4F)**.
- **Defence Ties:** Joint development of the **Barak-8 missile system**.
    - Regular Indian Navy **port calls at Haifa** and defence technology cooperation.

Source: Indian Express

News In Short

Combined Conference of Commanders	**News?** Prime Minister Narendra Modi will inaugurate the Combined Commanders' Conference (CCC) 2025 in Kolkata. **What is the Combined Conference of Commanders (CCC)?** ● It is the **apex-level annual meeting of the armed forces**. ● It brings together the **Chief of Defence Staff (CDS), service chiefs (Army, Navy, Air Force), and top commanders**, along with senior officials from the Ministry of Defence and the Prime Minister. ● **Purpose:** ○ To **review national security challenges**. ○ To **formulate military strategies** in line with India's defence needs. ○ To **discuss reforms and modernization** of the armed forces. ○ To **promote jointness and synergy** among the Army, Navy, and Air Force. **Related fact** ● It was traditionally conducted in **New Delhi** till **2014**. But in recent years it has been hosted at **different locations** (e.g., INS Vikramaditya (first time outside Delhi), Jodhpur in Rajasthan, etc.)
Himalayan Brown Beer 	**News?** A rare sighting of himalayan brown bear occurred in the Nelong and Jadung Valleys (HP). **About Himalayan Brown Bear (Ursus arctos isabellinus)** ● **Distribution:** Found in the **north-western and central Himalayas**: ○ **India:** Himachal Pradesh (Great Himalayan National Park), Uttarakhand (Gangotri NP, Nelong–Jadung Valleys), Ladakh (Suru & Zanskar valleys). ○ **Neighbouring regions:** Pakistan (Deosai NP), Nepal, Bhutan, Tibet (China). ● **Characteristics:** ○ **Size:** ■ **Males:** 150–230 cm, up to **400 kg**. ■ **Females:** 137–183 cm, smaller and lighter. ○ **Appearance:** ■ Sandy-brown to reddish-brown thick fur. ■ Heavy body, stocky legs, large head. ■ Least arboreal among bear subspecies (rarely climbs trees). ○ **Diet:** Omnivorous – grasses, roots, bulbs, insects, marmots, pikas, voles, fruits, berries, carrion, occasionally livestock. ○ **Behaviour:** Solitary (except mating season or mothers with cubs). ○ **Lifespan:** 20–30 years in the wild. ● **Conservation Status:**

	○ **IUCN Red List:** Vulnerable. ○ **India's Wildlife (Protection) Act, 1972:** Schedule I (highest protection). **Source:** New Indian Express
5th Fully literate state - Himachal Pradesh	**News?** Himachal Pradesh becomes 5th fully literate State/UT. **What is the Criteria?** ● A State or Union Territory (UT) is considered "fully literate" if it achieves a **literacy rate of 95% or above**. ● The **ULLAS initiative** (Understanding of Lifelong Learning for All in Society) under the New India Literacy Programme defines the criteria and benchmark (95%) for full literacy. ○ **Functional literacy** under ULLAS also includes critical life skills like **digital literacy**, **financial literacy**, and **numeracy**. **Other States** ● Tripura, Mizoram, Goa and Ladakh **Source:** PIB
Cholesterol	**News?** Scientists at the Institute of Nano Science and Technology (INST), Mohali have developed cholesterol-based nanomaterials that can control the spin of electrons. **What is Cholesterol?** ● **Cholesterol** is a **fat-like substance** found in all animal cells. ● It plays essential roles in the body, such as: ○ Building **cell membranes**. ○ Acting as a precursor for **hormones (estrogen, testosterone, cortisol)**. ○ Helping produce **vitamin D** and bile acids for digestion. ● It is a **cholesterol derivative's chirality (handedness) and flexibility** that make it a suitable material for designing **molecular spintronic devices**. **Source:** PIB

Places in News

Solomon Island

News? Leaders of the Pacific Islands Forum (PIF) will hold their meeting in the Solomon Islands.

About Solomon Islands

- A group of islands in the **South Pacific Ocean**, east of Papua New Guinea and northwest of Vanuatu.
- Part of **Melanesia** (one of the three main Pacific cultural areas).
- **Capital: Honiara** (on the island of Guadalcanal).
- **Economy:**
  - Based on **agriculture, forestry, fisheries, and mining**.
  - Rich in **timber, fish, gold, and bauxite**.
  - Heavy dependence on foreign aid and external investment.

About Pacific Island Forum (PIF)

- PIF is an intergovernmental organization of **18 Pacific island nations** focused on promoting regional cooperation, economic growth, security, and political stability (Founded in 1971).

Source: The Hindu

Personality in News

Sree Narayan Guru

News? Prime Minister Narendra Modi offered his tributes to Sree Narayana Guru on the occasion of his birth anniversary.

About Sree Narayana Guru

- Born in **Chempazhanthy, Kerala** in 1856, in the **Ezhava community**, which faced severe caste-based discrimination.
- He was a **saint, social reformer, philosopher, and spiritual leader**.
- His philosophy was rooted in **social equality, spiritual enlightenment, and universal brotherhood**.
- **Major Contributions:**
  - **Temple Entry & Social Reform:**
    - In 1888, consecrated a **Shiva temple at Aruvippuram**, challenging Brahmin monopoly over priesthood.
    - Consecrated many temples with inscriptions like *"This is a model abode where all live in brotherhood, devoid of caste discrimination."*
  - **Educational & Social Institutions:**
    - Established **Sree Narayana Dharma Paripalana (SNDP) Yogam** in 1903 to fight caste oppression and promote education.
    - Promoted schools, libraries, and hostels for lower-caste communities.
  - **Literary Works:**
    - Wrote philosophical works and devotional poems in Malayalam, Tamil, and Sanskrit.
    - Notable works: **Atmopadesa Śatakam (One Hundred Verses of Self-Instruction)**, *Daiva Dasakam*, and commentaries on major Hindu texts.
  - **Influence on Kerala Renaissance:**
    - Inspired leaders like **Mahatma Gandhi** (who met him in 1925 and called him a "great Hindu reformer").
  - His reforms played a key role in movements like the **Vaikom Satyagraha** and later the **Temple Entry Proclamation (1936)** in Travancore.

Source: Newsonair

Mains Topics

Role of Technology in empowering Farmers

Context

Technology-driven innovations like AI, IoT, drones, space applications, and JAM trinity are transforming Indian agriculture, empowering farmers and making farming more efficient, resilient, and inclusive.

Background

- Agriculture has been the backbone of India's economy for centuries, providing livelihood to nearly half of the population and ensuring national food security.
- Farmers, regarded as *Annadatas*, are central to this ecosystem. Yet, the sector faces persistent challenges: fragmented landholdings, climate variability, declining soil fertility, water stress, pest attacks, and market inefficiencies.
- To address these issues, the government is increasingly adopting the **"Beej Se Bazaar Tak" (seed-to-market)** approach. Modern technologies - Artificial Intelligence (AI), Internet of Things (IoT), drones, satellite mapping, and digital financial tools - are being integrated to make agriculture efficient, resilient, and farmer-centric.

Areas of Technology Integration in Agriculture

- **Precision Farming:** Optimising inputs like seeds, water, fertilisers.
- **Crop Health & Pest Management**: Early detection through AI-based advisories.
- **Climate Monitoring**: Using sensors, IoT, and satellites for weather-linked farming decisions.
- **Market Access & Finance**: Digital marketplaces (e-NAM), Direct Benefit Transfers (DBT), and online credit access.
- **Land & Property Records**: Drone mapping under schemes like **SVAMITVA**.
- **Post-Harvest Management:** Digital logistics, warehousing, and blockchain for traceability.

Role of various Sectors

Artificial Intelligence (AI) and Internet of Things (IoT)

- **Applications:**
  - AI/IoT tools enable climate monitoring, precision farming & irrigation, livestock tracking, drone-assisted spraying, soil health monitoring and smart greenhouses.
  - AI-enabled crop disease detection and yield forecasting.
- **Government Initiatives:**
  - **Kisan e-Mitra:** AI-powered chatbot answering queries on PM-Kisan, Kisan Credit Card, PM Fasal Bima Yojana. Works in 11 Indian languages, resolving 20,000 queries daily, and has answered 95 lakh+ farmer queries.
  - **National Pest Surveillance System (NPSS)**: AI/ML-based system covering 61 crops and 400+ pests. Farmers upload crop images for instant analysis; **10,154 advisories issued** by March 2025.

Space Technology in Agriculture

- **Applications:** Accurate forecasting, crop health monitoring, insurance claims support.
- **Government Initiatives:**
  - **FASAL Project (ISRO + MNCFC)**: Forecasts production of wheat, rice, sugarcane, jute, and pulses using satellite data.
  - **PM Fasal Bima Yojana (PMFBY)**: Uses space-based data for yield estimation and claim settlement.

- **Krishi Decision Support System (Krishi-DSS)**: Cloud-based geospatial platform integrating soil, water, weather, and satellite data for farm advisories.

Use of Drones in Agriculture

- **Applications:** Used for spraying pesticides, monitoring crops, precision farming, and land mapping.
- **Government Initiatives:**
  - **Namo Drone Didi Scheme (2023–26)**: ₹1261 crore outlay to provide 15,000 drones to women SHGs with 80% subsidy, empowering women as service providers.
  - **SVAMITVA Scheme**: Drone surveys conducted in 3.23 lakh villages (till July 2025), providing property rights and enabling farmers to access loans.

JAM Trinity in Agriculture

- **Applications:** Jan Dhan - Aadhaar - Mobile (JAM) ensures transparent, direct benefit transfers (DBT). Removes middlemen, curbs leakages, and empowers farmers financially.
  - **Eg:** On **2 Aug 2025**, the 20th instalment of PM-Kisan transferred ₹20,500 crore to 9.7 crore farmers' accounts.

Sustainability and Climate Action through Technology

- **Water Use Efficiency:** Drip irrigation supported by AI reduces overuse of groundwater.
- **Carbon Farming**: Technologies track carbon sequestration and enable farmers to earn from carbon credits.
- **Organic and Natural Farming**: Apps and e-platforms connect farmers with markets for sustainable produce.
- **Climate-Smart Agriculture:** Weather-based advisories reduce crop losses from floods or droughts.

Challenges in Integrating Technology in Indian Agriculture

- **Digital Divide and Connectivity Gaps:** Limited smartphone penetration and internet connectivity in rural areas.
- **Regional Language Barriers**: Many platforms are available only in English or Hindi, limiting access for farmers in states with different primary languages.
- **Affordability and Cost of Technology:**
  - **High Cost of Equipment:** Drones cost ₹7–10 lakh, IoT-based sensors and AI tools are still expensive for smallholders.
  - **Fragmented Landholdings**: With 85% of farmers in India being small or marginal (less than 2 ha landholding), purchasing advanced machinery individually is economically unviable.
- **Infrastructure Bottlenecks:**
  - **Power Supply Issues:** IoT devices and sensors need stable electricity, which remains unreliable in parts of rural India.
  - **Cold Chains and Storage**: Even if farmers adopt precision farming and improve yields, poor storage and logistics cause **15–20% post-harvest losses** (FAO, 2023).
- **Technical Challenges: IoT sensor failures** due to dust, monsoon flooding, or extreme heat reduce reliability. Also **Drone spraying** may not be effective in windy or hilly terrains.
- **Fragmented Implementation:** Different ministries (Agriculture, IT, Rural Development) run separate schemes with poor coordination.

Global Case Studies

- **Israel:** Israel, with its arid climate, pioneered drip irrigation technology that delivers water directly to plant roots, reducing wastage by 30–70%.
- **Netherlands:** Despite its small size, the Netherlands is the 2nd largest exporter of agricultural products globally. Its success is driven by climate-controlled greenhouses, LED lighting, hydroponics, and AI for optimal yield.
- **United States:** US farmers widely use GPS-enabled tractors, drones, and satellite imagery for precision farming. Companies like **John Deere** integrate AI and Big Data to guide sowing, irrigation, and harvesting.

Way Forward

- **Digital Literacy Campaigns:** Training farmers via KVKs, NGOs, and FPOs on AI, IoT, and drones.
- **Affordable Access**: Promote **Custom Hiring Centres** and FPO-led equipment banks for shared use.
- **Rural Connectivity**: Expand BharatNet to ensure high-speed internet in all villages.
- **Policy Support**: Encourage PPP models for drone services and AI platforms.
- **Localization of Technology**: Develop tools in regional languages for easy adoption.
- **Strong Data Protection**: Enforce clear laws on ownership and use of farm data.
- **Inclusive Approach**: Target support to **small, marginal, women, and SC/ST farmers** for equitable adoption.

Source: PIB

Women's Domestic Work and the Invisible Burden

Context

The discourse on "nari shakti" and women-led development is rising, yet women's domestic contributions remain undervalued and invisible in policy and economic frameworks. Recognising this gap is essential for achieving gender equality and inclusive growth in India.

Violence and Inequality in the Domestic Sphere

- **Dowry Deaths**: Between 2017–2022, nearly **35,000 women** lost their lives in dowry-related burnings, averaging 7,000 deaths annually.
- **Domestic Violence**: NFHS-5 reported that **30% of women face intimate partner violence**, but only 14% file police complaints, reflecting fear, stigma, and lack of support.
- **Crimes Against Women**: One-third of all registered crimes against women relate to domestic violence, yet such issues receive little attention in mainstream political debate.
- **Legal Resistance**: Opposition to criminalising marital rape and attempts to dilute domestic violence laws highlight systemic neglect of women's rights in the home.

Time Use Survey 2024: Unequal Division of Work

- **Employment and Enterprise:** 25% of women (15–59 yrs) engaged in employment, working ~5 hours daily, vs 75% of men working ~8 hours.
- **Unpaid Domestic Work**: 93% of women spend 7 hours daily on cooking, cleaning, washing. By contrast, only 30% of men do any domestic work, averaging <1.5 hours.
- **Unpaid Caregiving**: 41% of women provide 2.5 hours daily, while only 21% of men contribute, averaging just over 1 hour.
- **Overall Burden:** Women's total working hours (paid + unpaid) exceed men's, leaving them less time for sleep, leisure, and self-care.

Implications of Unpaid Domestic Work

Economic Implications

- **Invisible GDP contribution**: Women's unpaid work equals ~**7% of GDP (₹22.5 lakh crore, SBI 2023)**, yet not counted in national accounts.
- **Keeps wages low**: Household labour subsidises the cost of living for workers, lowering wage demands.
- **Lost growth potential**: Low Female Labour Force Participation Rate (**41% vs men's 78%**) reduces India's productivity; closing the gap could raise GDP by **27% (McKinsey, 2015)**.

Social Implications

- **Time poverty**: Women spend ~**7 hrs/day** on domestic work (TUS 2024) vs men's 26 minutes → less rest, education, and leisure.
- **Reinforces patriarchy**: Seen as "natural duty", unpaid work limits women's autonomy and keeps them dependent.
- **Undervaluation of care work**: Anganwadi, ASHA, and mid-day meal workers are underpaid and treated as "volunteers".

Policy Implications

- Excluded from **labour laws, wage policies, and poverty estimates**.
- Leads to **underfunded childcare, healthcare, and eldercare services** since the state assumes women will provide them.
- Recognition and redistribution of care work is essential for **gender-just policies.**

Way Forward

- **Address Violence in the Domestic Sphere:**

    - Strengthen legal protections under the Domestic Violence Act, 2005.
    - Criminalise marital rape and ensure robust implementation of dowry and honour-crime laws.
- **Recognition of Women's Unpaid Work:** Integrate unpaid care and domestic work into GDP calculations and minimum wage frameworks & Provide social security benefits for unpaid caregivers.
- **Child and Elder Care Infrastructure:** Universal, state-supported creches, elder-care, and health facilities to reduce women's unpaid care burden.
- **Equal Employment Rights:** Recognise Anganwadi, ASHA, and Mid-Day Meal workers as government employees with fair wages and benefits.
- **Cultural Transformation:** Campaigns to promote shared domestic responsibilities between men and women.
- **Data and Policy Innovation:** Regular time-use surveys disaggregated by caste, class, and region & Evidence-based policymaking to design gender-sensitive social protection.

Source: The Hindu