DAILY CURRENT AFFAIRS 04-06-2025

GS-3

1. **Lysosomal Storage Disorders**
2. **BharatGen**
3. **First-Person View Drones**
4. **Caspian Gull**
5. **Phytoplankton**

Lysosomal Storage Disorders

Syllabus: GS-3: General Science – Diseases.

Context:

Despite the establishment of the National Policy for Rare Diseases (NPRD) in 2021 and a nationwide financial assistance programme, over 300 patients, predominantly children diagnosed with Lysosomal Storage Disorders (LSDs), are left without essential medical care.

Lysosomal Storage Disorders (LSDs)

- LSDs are a group of **rare inherited metabolic disorders** caused by defects in lysosomal function.
- Result in the **accumulation of undigested macromolecules** (toxins) in various tissues.

Cause

- Caused primarily by **mutations in genes** encoding:
  - **Lysosomal enzymes**
  - **Enzyme activators/modifiers**
- These mutations prevent the **breakdown of fats, sugars, and other substances**, leading to harmful buildup.

Lysosome Function

- Lysosomes are **membrane-bound organelles** in cells containing digestive enzymes.
- Key roles:
  - **Breakdown of waste materials and cellular debris**
  - Involved in **metabolism and recycling cell components**

Examples of LSDs

- Gaucher disease
- Pompe disease
- Fabry disease
- Mucopolysaccharidoses (MPS I, MPS II, etc.)

- Mucolipidoses
- Oligosaccharidoses

Genetic Inheritance

- Most LSDs are **autosomal recessive**:
  - Affected individual inherits two defective genes (one from each parent)
- **Exceptions**:
  - **Hunter syndrome (MPS II)** and **Fabry disease** are **X-linked disorders**

Onset & Severity

- Often present **in utero or infancy**
- Rarely manifest in **adulthood**
- **Earlier onset = more severe** symptoms
- **Later onset = milder** disease progression

Symptoms & Effects

- Symptoms vary depending on the specific disorder, but may include:
  - Organ enlargement
  - Neurological deficits
  - Bone abnormalities
  - Developmental delays
- Accumulated substances lead to **organ dysfunction, morbidity, and mortality**

Treatment

- No permanent cure
- Treatments aim to **manage symptoms** and **reduce organ damage**:
  - Enzyme Replacement Therapy (ERT)
  - Substrate Reduction Therapy (SRT)
  - Hematopoietic Stem Cell Transplantation (HSCT)
  - Supportive care and symptomatic treatment

BharatGen

Syllabus: GS-3: Science and Technology – Artificial Intelligence.

Context:

- India launched *'BharatGen'*, its **first government-funded multimodal Large Language Model (LLM)**, at the **BharatGen Summit 2025**.

What is BharatGen?

- A **multimodal Large Language Model (LLM)** developed to support:
  - **Text**, **speech**, and **image-based** AI outputs.
- Trained in **22 Indian languages**, including major and regional dialects.
- Developed to meet India's **linguistic, cultural, and regional diversity** needs.

Developed By:

- **TIH Foundation for IoT and IoE**, **IIT Bombay**.
- Funded under the **National Mission on Interdisciplinary Cyber-Physical Systems (NM-ICPS)**.

Objectives:

- Build a **democratic AI ecosystem** rooted in Indian values and languages.
- Create **inclusive, ethical, and regionally sensitive** AI tools.
- Provide AI-based solutions across **governance, health, agriculture, and education**.
- Promote **AI innovation, entrepreneurship**, and R&D in India.

Key Features:

Multimodal Capabilities

- Processes **text, speech, and images** — enabling wide AI applications.

Language Diversity

- Trained in **22 Indian languages** — ensuring **linguistic inclusivity**.

Inclusive Development

- Focus on **rural and underserved communities**.

- Aids in **local governance, public health, and digital education**.

Scalability

- Supports national platforms:
  - **CPGRAMS** (grievance redressal),
  - **AI-powered telemedicine**,
  - **NEP 2020-based digital education**.

Collaborative Model

- Joint efforts of:
  - Government,
  - Academia,
  - Startups,
  - Students via **hackathons**, **R&D parks**, etc.

Significance:

Technological Sovereignty

- Boosts India's capability in **home-grown foundational AI models**.

Cultural Relevance

- Promotes **context-aware AI** suited to Indian social, cultural, and linguistic needs.

Educational Integration

- Embeds AI within **NEP 2020 framework**, bridging **humanities and technology**.

Alignment with "India's Techade" Vision

- Drives **inclusive, tech-enabled growth** and **digital empowerment**.

First-Person View Drones

Syllabus: GS-3: Defence Technology – Drones.

Context:

- Recently, Ukraine used **First-Person View drones** to **strike Russian military assets**, reportedly **destroying over 40 planes**.

- Marks a significant advancement in **low-cost, high-impact warfare using AI-enabled drones**.

What are FPV Drones?

- **Unmanned Aerial Vehicles (UAVs)** that allow the pilot to view real-time video through a camera mounted on the drone.
- Controlled using **goggles**, **smartphones**, or **screens**, offering a **first-person perspective**.
- Often enhanced with **Artificial Intelligence (AI)** to perform **precision-based and autonomous tasks**.

Working Mechanism

- **Two-step operation**:
  - A **long-range reconnaissance drone** first surveys the target area.
  - Then, a **short-range FPV drone** carries out the precise attack.
- FPV drones typically have a **limited range of a few kilometres**.

Key Features

- **GPS-independent navigation**:
  - Operates without relying on GPS; resilient to **signal jamming and spoofing**.
- **SmartPilot system**:
  - Uses **visual-inertial navigation** by interpreting **camera data and motion sensors** to navigate.
- **LiDAR (Light Detection and Ranging)**:
  - Helps in navigating **complex terrains**, avoiding obstacles with greater precision.

Advantages

- **Cost-effective**: Much cheaper than conventional missile systems.
- **Deep strike capabilities**: Can infiltrate enemy lines undetected.
- **Minimal human risk**: Operated remotely.
- **Stealth**: Small size and low radar signature make them hard to detect.

Challenges

- **Limited range and battery life**.
- **Reduced situational awareness**:
  - Operators may get disoriented as peripheral surroundings are not visible.
- **Need for visual observers** in some cases.
- **Vulnerability to electronic warfare**, such as jamming or hijacking signals.

Civilian Uses

- Widely used in:
  - **Filmmaking**
  - **Search and rescue operations**
  - **Agriculture**
  - **Infrastructure inspection**

Significance in Warfare

- Marks a shift toward **asymmetric warfare**.
- Allows **non-state actors or smaller nations** to challenge larger military powers.
- Enhances **tactical flexibility** and supports **surgical strikes**.

Conclusion

First-Person View drones, combining real-time vision with AI and autonomous navigation, represent a **transformative shift in modern warfare and civilian technology**, raising both **strategic opportunities and ethical/security challenges**.

Caspian Gull

Syllabus: GS-3: Environment - Wildlife

Context:

- The Caspian Gull, which often migrates to northwest India during winter, was sighted on Kappad beach in Kozhikode in February 2020.

Caspian Gull

Overview

- The **Caspian Gull** is a **monotypic, large, white-headed gull**.
- It is one of the **rarest gulls seen in India**.
- **Scientific Name**: *Larus cachinnans*

Habitat

- **Breeding Season**:
  - Nests on **flat, low-lying ground near water bodies**.
  - Found near **lakes with reedbeds** in **steppe and semi-desert regions** of **Central Asia**.
  - Also breeds near **reservoirs**, **rivers**, and **grassy/shrubby islands**.
- **Wintering Grounds**:
  - Visits **northwestern India** (e.g., **Gujarat**) during winter.
  - Expands wintering range from **eastern Mediterranean to Persian Gulf and western India**.
  - Increasing dispersal into **Europe**: Sweden, Norway, Denmark.

Distribution & Migration

- **Breeding range**: From the **Black Sea to the Caspian Sea**, **southern/eastern Kazakhstan**, and **western China**.
- **Wintering range**: Parts of **Asia** and **Africa**, including **India**, especially **Gujarat**.

Identification

- Very **difficult to distinguish** from **Steppe Gull** due to close resemblance.
- Requires expertise in gull morphology for proper identification.

Diet

- **Carnivorous and opportunistic**.
- Feeds on:
  - **Fish**
  - **Invertebrates** (e.g., insects, molluscs)

Conservation Status

- IUCN Red List: Least Concern (LC)

Phytoplankton

Syllabus: GS-3: Biodiversity – Phytoplanktons.

Context:

- A new study by oceanographers from the University of Hawai'i at Mānoa has revealed the ecological effects of industrial iron in the **North Pacific Transition Zone** (NPTZ).
- Published in the *Proceedings of the National Academy of Sciences (PNAS)*.

Importance of Iron for Marine Life

- Along with **nitrogen and phosphorus**, **iron** is an essential nutrient for **phytoplankton growth**, the primary producers in marine food webs.
- Phytoplankton form the **base of the oceanic food chain**, supporting fisheries and higher marine organisms.

Source and Transportation of Industrial Iron

- Major sources include **coal combustion** and **steel manufacturing**.
- Industrial iron is released into the atmosphere and carried over long distances via wind currents.
- Eventually deposited into oceans via **rainfall** (wet deposition).

Key Findings of the Study

- **Location Studied**: North Pacific Transition Zone – a biologically rich region just north of Hawai'i, crucial for Pacific fisheries.
- **Seasonal Phytoplankton Dynamics**:
    - Phytoplankton are **iron-deficient during spring**.
    - Influx of industrial iron **triggers spring blooms**.
    - **Subsequent crash** due to depletion of other nutrients.

Isotopic Evidence

- Water and phytoplankton samples revealed a **distinct industrial isotope signature of iron**.

- Confirms long-range transport of anthropogenic iron into remote ocean regions.

Ecological Impacts

- Altered **nutrient cycling** and **phytoplankton dynamics** due to excess iron.
- Impacts the **marine food web**, possibly affecting fisheries and biodiversity.
- The **boundary of the Transition Zone** is shifting **northward** due to:
    - Increased industrial iron.
    - **Ocean warming**.

Implications for Hawai'i and Global Marine Ecosystems

- Near-Hawai'i regions of the Transition Zone are among those most affected.
- **Double threat**:
    - **Anthropogenic iron input** alters ecosystem dynamics.
    - **Climate change** (warming oceans) shifts productive zones further north.

Phytoplankton

Definition

- Microscopic, photosynthetic organisms (mostly algae and cyanobacteria) found in aquatic ecosystems.
- Base of the marine and freshwater food chains.

Types

- **Diatoms**: Silica-shelled; dominant in cold, nutrient-rich waters.
- **Dinoflagellates**: Motile; some cause harmful algal blooms (e.g., red tides).
- **Cyanobacteria (Blue-green algae)**: Prokaryotes; fix atmospheric nitrogen.

Ecological Importance

- **Primary Producers**: Contribute ~50% of global photosynthesis (oxygen production).
- **Carbon Sequestration**: Absorb CO_2; play a role in the **biological carbon pump**.
- **Food Web**: Support zooplankton, fish, and marine mammals.

Factors Affecting Growth

- **Light**: Require sunlight for photosynthesis (euphotic zone).
- **Nutrients**: Depend on nitrates, phosphates, and iron (limiting factor in oceans).
- **Temperature & Salinity**: Thrive in optimal ranges; affected by climate change.

Phytoplankton Blooms

- Rapid multiplication due to nutrient influx (e.g., upwelling, pollution).
- **Harmful Algal Blooms (HABs)**: Toxins can kill marine life and harm humans.