UPSC Daily Current Affairs| Prelim Bits 15-04-2025

Cu-Phen

Prelims – *General Science*

Mains – *General Studies-III (Science and Technology- developments and their applications and effects in everyday life. | Achievements of Indians in science & technology | Awareness in the fields of IT, Space, Computers, robotics, nanotechnology, biotechnology, and issues relating to intellectual property rights)*

Why in news?

Indian scientists at CSIR-Central Leather Research Institute (CLRI), Chennai have recently developed specialized Nano-sized particles called Cu-Phen that mimic the function of natural enzymes in our bodies.

- **Enzymes** – Are nature's catalysts, essential biological molecules that speed up chemical reactions vital for life.
- **Artificial enzymes** – Also known as nanozymes, which mimic the natural functions of enzymes using nanomaterials.
- These nanozymes hold immense potential in fields ranging from medicine to energy.

Challenge with First-Generation Nanozymes

- Earlier nanozymes often faced significant hurdles, limiting their practical application, especially within biological systems.
- A key challenge was their lack of specificity, often stemming from poorly defined "active sites" which are the parts responsible for the catalytic activity.
- This lack of precision could lead to:
  - Uncontrolled Electron Transfer
  - **Generation of Harmful Byproducts** – Leakage of electrons often resulted in the production of toxic Reactive Oxygen Species (ROS).
  - ROS can cause oxidative stress, damaging cells and contributing to various diseases and aging.
- These limitations posed risks, particularly for therapeutic applications, necessitating the development of next-generation nanozymes with better control and safety profiles.

Working Mechanism

- Cu-Phen is meticulously *self-assembled from copper ions (Cu^{2+})* coordinated with ligands (a molecule that binds to another) *derived from the amino acid phenylalanine*.
- It interacts precisely with ***cytochrome c***, a vital protein in the mitochondrial electron

transport chain (the cell's primary energy-generating pathway).
- It binds to cytochrome c in a specific manner, similar to natural enzyme-substrate interactions.
- It facilitates the efficient transfer of electrons from cytochrome c.
- These *electrons are then used to reduce oxygen directly to water (H_2O)*, the safe end-product seen in natural cellular respiration.

Significance & Potential Applications

- **Well-Defined Active Site** – Unlike its predecessors, Cu-Phen features a *precisely engineered and defined active site*. This structural precision is key to its enhanced function.
- **Overcoming Limitations** – Its specific design enables *controlled electron transfer*, mimicking the efficiency of natural enzymes involved in cellular energy pathways.
- Crucially, this controlled process *avoids the generation of harmful ROS*.
- **Health & Therapeutics** – Its ability to function efficiently without producing harmful ROS makes it a prime candidate for *safer biomedical applications*.
- **Bioenergy** – Precise control over electron flow is fundamental to energy conversion.
- Cu-Phen could contribute to developing *more efficient biocatalysts for sustainable energy production* or understanding and manipulating cellular energy pathways.
- **Biotechnology & Environment** – Cu-Phen can guide the *development of advanced artificial enzymes for various biotechnological processes* and potentially environmental remediation tasks requiring specific catalytic activity.

Reference

PIB | Cu-Phen

Sea Lions

Prelims – *Current events of national and international importance| General issues on Environmental ecology, Bio-diversity.*

Mains (GS III) – *Conservation.*

Why in News?

Recently, a toxic algae bloom on Southern California's coast sickened dozens of sea lions and caused them to become aggressive.

- **Sea lions** – They are ***large marine mammals*** belonging to the clad *Pinnipeds*.

  Pinnipeds *are a group of aquatic, fin-footed mammals that include seals, sea lions, and walruses.*

- **Scientific name –** *Otariinae*, means “little ear” in Greek, refers to their small external

ear flaps.

- **Species of sea lion**
  - Australian sea lion
  - Galapagos sea lion
  - New Zealand sea lion
  - Steller sea lion
  - South American sea lion
  - Californian sea lion
- **Distribution** – Pacific Ocean, Bering Sea to southern South America, Falkland Islands in the southern Atlantic Ocean, and others living around Australia and New Zealand.
- **Habitat**—They live on both land and the sea, resting and mating on rocky islands, bays, and coastal beaches.
- **Morphology** – They have a blunt snout, small tail, excellent eyesight, coarse hair and small external (outside) ears with fur seals.
- Their colour ranges from golden brown to dark brown but often looks darker when wet.

- **Characteristics –** They are ***generally social, non-aggressive animals*** and cool off in the ocean during warm weather.
- **Diet** – Feed on fish and large animals like great white sharks, hammerhead sharks, blue sharks, and killer whales.
- **Major threat - Toxic algal blooms** – It is commonly referred to as ***red tides***.
- These blooms produce ***domoic acid***, a neurological toxin that makes its way up the food chain and into the diets of marine animals.

Domoic acid (DA) is primarily produced by specific diatoms in the genus Pseudo-nitzschia.

- When sea lions consume these marine animals, the neurotoxin affects their neurological functions.

- They get the effects of Difficulty breathing, seizures, and stargazing, in which sea lions unnaturally tilt their heads backwards with closed eyes.
- They act erratically, even aggressively, resulting in attacks on swimmers and surfers.

The Marine Mammal Care Center in Los Angeles facing an unprecedented crisis and treating 240 animals so far in 2024.

- **Conservation status**
  - **IUCN –** Endangered.

References

1. The Times of India| Toxic Algal Blooms threat Sea Lions
2. IFAW| Sea lions

Signet Ring Cell Carcinoma (SRCC)

Prelims – *General Science.*

Mains (GS II) *- Issues relating to development and management of Social Sector/Services relating to Health, Education, Human Resources.*

Why in News?

A team of scientists has developed new ways to better understand and treat signet ring cell carcinoma (SRCC).

- It is a ***rare form of colon cancer (CRC)*** and is considered one of the deadliest subtypes of the disease.

Colon cancer, also known as colorectal cancer, is a type of cancer that originates in the large intestine (colon) or rectum.

- It gets its name from the signet ring-like appearance (a finger ring with a flat top) of its cancer cells under a microscope.
- It most commonly develops in the ***gastrointestinal tract***, particularly the stomach, but can also occur in the colon and other organs. It spreads quickly.
- **Symptoms –** Indigestion, Abdominal pain, Nausea and vomiting, Diarrhea, Bloody stools, Fatigue, Joint pain, Pallor (paleness, fast heartbeat and trouble breathing).
- **Prevalence** - CRCs are the 3rd most common cancer and the 2nd leading cause of cancer deaths in the world. Globally, this type of cancer constitutes about **1%** of all cases of CRC.
- It resists conventional therapies, and is often diagnosed at advanced stages.
- **Severity -** It has the tendency to spread to the peritoneum.

The peritoneum is a smooth, transparent membrane that lines the abdominal cavity and covers most of the organs in the abdomen.

- **Treatment -** Surgery, chemotherapy, and other therapies, often used in a multidisciplinary approach.

Recent Findings of the study

- Researchers have developed miniature representations of *actual human SRCC tumors* cultivated in laboratory petri dishes and subsequently implanted into mice.
- It provides valuable opportunity to investigate cancer in detail and evaluate potential therapies within a controlled setting.
- The research has revealed *distinct molecular traits of SRCC* that clarify its resistance to conventional chemotherapy.
- The research team also explore a variety of drug combinations to identify therapeutic vulnerabilities, specific weaknesses that could be targeted with focused treatments.
- Among the most encouraging outcomes of the study was the testing of a novel three-drug combination, which not only reduced tumor size but also inhibited the cancer's progression in laboratory models.

Reference

The Indian Express | Signet Ring Cell Carcinoma (SRCC)

Typhloperipatus Williamsoni

Prelims – *Current events of national importance| General issues on Environmental ecology, Bio-diversity.*

Mains (GS III) – *Conservation.*

Why in News?

A group of scientists has announced the rediscovery of a long-forgotten species of velvet worms (phylum Onychophora), which are among the oldest living fossils on the planet, after a gap of 111 years.

- It is an ***ancient velvet worm species*** (phylum Onychophora), one of the oldest living fossils in the world.

Onychopora
• It has an ancient lineage that dates back over 350 million years. • It comprises only two families and fewer than 200 species, indicating a limited diversity. • These organisms evolved alongside dinosaurs, and it is likely that many were lost during the mass extinction event.

- **First discovered in -** December 1911 in Siang Valley.
    - After that there have been no documented records of it from India.
- The molecular analysis of T. williamsoni revealed that South Asian onychophoras diverged from their
    - Neotropical counterparts, those found in Central and South America, as well as
    - Southern Mexico and the Caribbean approximately 237 million years ago.
- Notably, it was discovered that ***Asian onychophoras*** lack any relatives among the Australian species.
- This finding is particularly striking, as invertebrates from Southeast Asia and India typically share connections with those in Australia.
- Asian onychophora stands out as one of the rare exceptions to this relationship.

Reference

The Hindu | Typhloperipatus williamsoni

Gaurav Glide Bomb

Prelims – *General Science.*

Mains (GS III) – *Science and Technology Developments.*

Why in News?

Defence Research and Development Organisation (DRDO) has successfully conducted the release trials of the long-range glide bomb "Gaurav" from the Sukhoi aircraft.

- Gaurav is a ***long-range glide bomb*** designed for precision strikes ***on land targets*** from a safe distance, specifically beyond the reach of enemy air defenses.
- **Developed by –** DRDO in partnership with the Armament Research and Development

Establishment (ARDE), Research Centre Imarat, and the Integrated Test Range.

- **Features - Range** - Capable of operating between 30 km and 150 km, with successful demonstrations nearing 100 km.
- **Weight** - The winged variant, Gaurav, has a mass of 1,000 kg, while the non-winged version, Gautham, weighs 550 kg.
- **Navigation** - It employs an ***Inertial Navigation System (INS)*** complemented by satellite guidance and digital control mechanisms.
- **Importance for India's Defence**
  - This system significantly boosts the Indian Air Force's (IAF) ability to conduct stand-off strikes.
  - It minimizes the exposure of fighter aircraft to enemy air defenses, thereby enhancing operational safety.
  - Furthermore, it reinforces India's capabilities in developing indigenous smart munitions and supports precision targeting, which is crucial in contemporary warfare.

Reference

The Hindu | Glide Bomb 'Gaurav'

One Liners 14-04-2025

History, Art and Culture

Jallianwala Bagh Massacre

On a recent occasion, the Prime Minister honored those who tragically lost their lives in the Jallianwala Bagh massacre of 1919.

• This horrific event unfolded on *1919*, in Jallianwala Bagh, Amritsar.
• **Tragedy** – Hundreds of unarmed and peaceful civilians gathered to protest against the *Rowlatt Act of 1919*.
• **Causes** – The Gurkha British Indian army, acting under the command of Brigadier *R.E.H. Dyer, carried out the brutal firing* upon the defenseless crowd.

Ambedkar Jayanti

Recently, India observed the 135th Dr. Ambedkar Jayanti on April 14th, 2025.

• It is observed annually to commemorate *Dr. Ambedkar birth anniversary*.
• Bhimrao Ramji Ambedkar, popularly known as Babasaheb was born in *1891* at Mhow, Central Province(now Madhya Pradesh).
• He was a renowned jurist, economist, and social reformer.
• He was the *Chairman of the Drafting Committee* for the new Constitution.
• He is known as the *Father of the Indian Constitution* and was the *1^{st,} Law Minister*.

Polity & Governance

The Hindu Code Bill

The Supreme Court recently recalled the first President's power struggle over Hindu Code Bill in the Tamil Nadu's Governor case.

• **Introduced in** – *1950*, when Ambedkar was Law Minister.
• **Objectives** – To codify and *modernize Hindu law*, specifically focusing on granting *enhanced rights to women*.
• To *equalize social laws* between men and women within the Hindu community.
• **Significance** – It focused on issues like *marriage, divorce, inheritance, and guardianship.*
• It *represents a crucial aspect of Ambedkar's vision* for social reform.
• **Role of the President** – Dr. Rajendra Prasad had sought to assert his independent authority *to withhold assent to the legislation.*
• Jawhaharlal Nehru government had referred the issue to the Attorney General of India, MC Setalvad, for an opinion.
• Mr. Setalvad clarified that the role of the President under the Indian Constitution was analogous to that of the British monarch and he was expected to serve as a constitutional figurehead

Kavach 5.0

Recently, the Railway Ministry announced the launch of 'Kavach 5.0 for Mumbai's suburban trains.

• **Kavach** – It is an indigenous *Automatic Train Protection (ATP)* system to enhance railway safety.
• **Developed by** – Research Designs & Standards Organisation (RDSO).
• **Aim** – To prevent train collisions and over speeding by automatically initiating brake application when necessary.
• **Kavach 5.0** – It is a *new and an advanced version*, currently under development.
• It will be implemented to *increase the number of Mumbai local trains by 30%.*

Karnataka Caste Census Report

Recently, the Caste Census Report was submitted to Karnataka Chief Minister, marking a significant step in the state's socio-economic landscape.

• **Based on** – Socio-Educational Survey, 2015, which was conducted by the Karnataka State Commission for Backward Classes in 2015.
• **Aim** – To develop and *uplift the backward classes in Karnataka*.
• **Methodology** – The Data was collected using *54 indicators*, to understand the socio-economic conditions of various caste groups.
• **Significance** – It contains detailed social and economic indicators for *non-SC/ST communities*, including taluk-wise data and insights from secondary sources.

International Relations and Issues

Safeguard American Voter Eligibility (SAVE) Act

The United States (US) House of Representatives recently approved the SAVE Act.

• It is a Republican-backed bill, *mandates that individuals provide proof of U.S. citizenship* when registering *to vote and to update the name or address changes*.
• **Objective** – To enhance election integrity by preventing non-citizens from voting in U.S. elections.
• **Existing federal law** – It *prohibits non-citizens from voting*, with significant penalties in case of violations.
• **Impact** – It will affect *new voter registrations.*

Sudan's Humanitarian Crisis

The United Nations stated that Sudan is currently facing worst humanitarian crisis, marked by extreme hunger affecting nearly half of its population.

• It is the *world's largest humanitarian emergency*, over 25 million people require urgent assistance.

• **Causes** – The ongoing *civil war*, is the primary cause of widespread suffering and immense humanitarian needs across the nation.

• **Impacts** – It has triggered *mass displacement*, over 8 million people to flee their homes within Sudan and an additional 4 million have sought refuge in neighbouring countries.

• Women and girls are disproportionately affected, facing heightened risks of *gender-based violence and severe food insecurity*.

Security

India's BM-04 Missile

India's DRDO recently unveiled the BM-04, a next-generation short-range ballistic missile (SRBM) akin to the Agni-P, specifically targeting Pakistan with conventional capabilities.

• **Technical Specifications** – The BM-04 is 10.2m long, weighs 11,500 kg, and has a 1,500 km range with a 500 kg conventional warhead and 30m CEP.

• It utilizes a *two-stage solid-fuel system* and a six-wheel Transporter Erector Launcher (TEL) for launch.

• **Advanced Features** – Likely a hypersonic missile with AI assistance, the BM-04 can be upgraded with new technologies.

• Its manoeuvrable re-entry vehicle that is designed to evade enemy air defences, enabling strikes on time-sensitive targets.

• **Strategic Implications** – A potential pre-emptive strike posture *against Pakistan's military assets* and critical infrastructure from a safer distance.

Science

Acoustic Test Facility (ATF)

Recently, the Underwater Acoustic Test Facility (ATF) at the National Institute of Ocean Technology (NIOT) has attained global recognition and international certification.

• **Established in** – *2004*.

• It is the only facility accredited by the *National Accreditation Board for Testing and Calibration Laboratories (NABL)*.

• **Objective** – To enhances ocean observation capabilities, supports tsunami detection systems, and reinforces national security.

• It includes precise testing and calibration of a wide range of underwater acoustic instruments such as hydrophones, transducers, and acoustic modems

• **Significance** – ATF is *India’s only facility accredited by the National Accreditation Board for Testing and Calibration Laboratories (NABL) for hydrophone calibration*.

• **Underwater Acoustic Test Facility (ATF)** – It is crucial for ensuring measurement accuracy across strategic sectors.

• In the field of underwater acoustics under the International Bureau of Weights and Measures (BIPM), Paris, have recognised the underwater ATF facility of CSIR-NPL.

Affordable Medicines and Reliable Implants for Treatment (AMRIT) Pharmacy

Recently, the Union Minister of Health inaugurated the EHS Clinic and AMRIT Pharmacy in Bhubaneswar, Odisha.

• It is a *pharmacy chain initiative* of the Ministry of Health & Family Welfare.
• **Operated by** – HLL Lifecare Ltd.
• **Objective** – To *provide essential medicines, life-saving drugs, and medical devices at affordable prices to the public*.
• It provides a wide range of products, including specialised medicines for,
- Oncology and Cardiology, stents, orthopaedic implants, medical disposables, and a variety of branded and generic drugs at *discounts of up to 50% on MRP*.
• **Significance** – It supports tertiary healthcare facilities such as AIIMS, medical colleges, district hospitals and general hospitals across India.