

**SCIENCE & TECH.
DISEASES
PRELIMS SPECIAL**

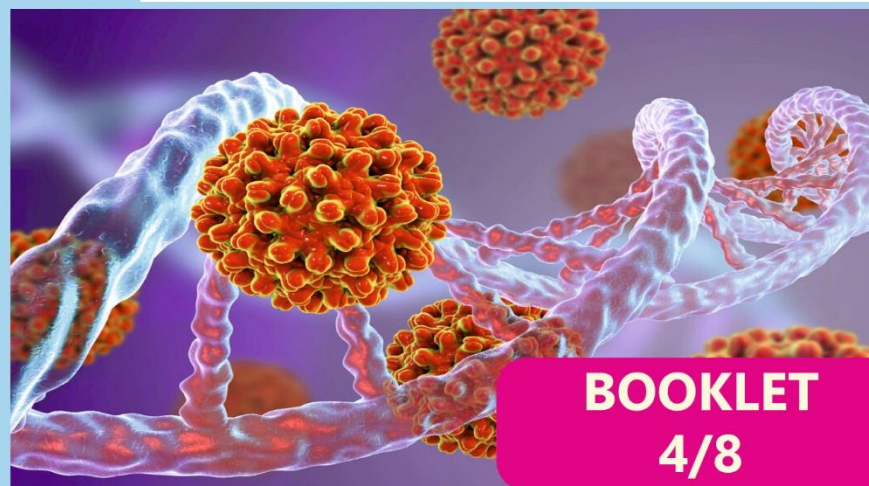
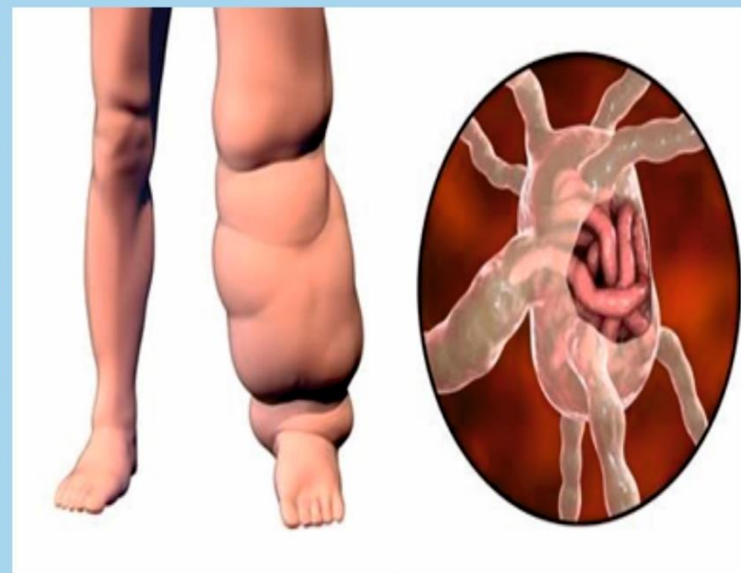
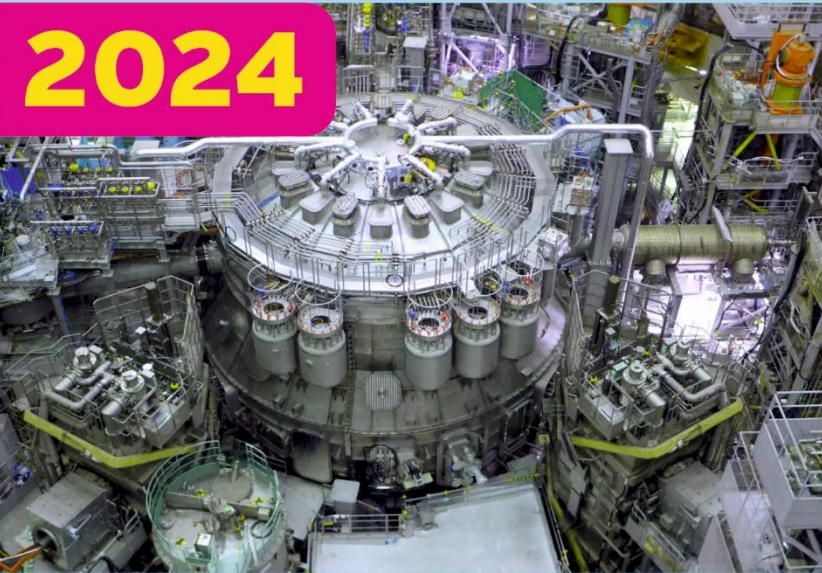
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YEARLY COMPILATION

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2024



**BOOKLET
4/8**

(MAY 2023 - DECEMBER 2023)

■■■ PART ONE



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GENERAL SCIENCE

Biohacking

News Excerpt:

Biohacking is picking up in India, with followers trying everything from cryotherapy to IV therapy.

About Biohacking:

- Biohacking is the practice of employing methods drawn from fields like biology, genetics, neuroscience and nutrition to enhance **physical or mental performance**, improve overall health and well-being, or achieve a specific health outcome (like weight loss).
- Sometimes biohacking is also called **do-it-yourself (DIY) biology**.

Types of Biohacking:

- Almost any tactic could be considered biohacking if an individual employs it to enhance **their biology** in some way.
- **Lifestyle:**
 - This category of biohacking focuses on making **positive health and behaviour choices**, as well as embracing ways of life that **activate the biology of performance and longevity**.
 - Lifestyle is probably the most accessible way most people can start experiencing biohacking, as it includes factors like **dietary shifts, breathwork, meditation and exercise**.
- **Molecular:**
 - Molecular biohacking involves the use of **natural and synthetic molecules** that can help shift one's biology.
 - Taking supplements would fall into this biohacking category.
- **Biologics:**
 - Biologics are cellular or biological products that are meant to **improve or enhance biology**. Biologics function like some sort of **human cellular material**.
 - They could be **cells**, or could be small little information packets like **exosomes**, which are basically biological bundles of **DNA, mRNA proteins and growth factors**.
- **Technology:**
 - Biohacks in this category include devices like wearables (such as **smartwatches**) and diagnostics (such as **blood sugar monitors**).
 - In such cases, biohacking uses technology to gather data about the body.
 - It functions so that an individual can use that information to adjust their health as they **strive for improved performance**.

- Technology biohacks also include use of advanced machines like **hyperbaric chambers or electromagnetic stimulators** to try and stimulate more rapid physiological changes or healing.

Rocks with the oldest evidence of Earth's magnetic field discovered

News Excerpt: Geologists at MIT and Oxford

University have found ancient rocks in **Greenland** that bear the oldest remnants of **Earth's early magnetic field**.

More about the Study:

- The researchers determined that the rocks are about **3.7 billion years old** and retain signatures of a magnetic field with a strength of at **least 15 microtesla**.
 - The ancient field is similar in magnitude to the **Earth's magnetic field** today.
- The results represent some of the earliest evidence of a magnetic field surrounding the Earth.
- The researchers suspect that an early magnetic field played a critical role in making the **planet habitable** by retaining a **life-sustaining atmosphere and shielding the Earth** from damaging **solar radiation**.
- The objective of the researchers was to find rocks that still held **signatures of the Earth's magnetic field** when the rocks first formed,
 - The team sampled rock formations in the **Isua Supracrustal Belt** in **southwestern Greenland**.
- The researchers carefully sampled **banded iron formations**, which are rock types like stripes of **iron-rich and silica-rich rock**.
 - Researchers suspect that the rocks formed in **primordial oceans** before the rise of **atmospheric oxygen** around **2.5 billion years ago**.
- Through careful analysis using **uranium-lead ratios** and **re-magnetization techniques**, the team concluded that the rocks likely harboured this ancient 3.7-billion-year-old magnetic field.

World Energy Congress

News Excerpt:

The **26th World Energy Congress** was held in **Rotterdam** to shape the future of energy once again.

About World Energy Congress:

- The 26th **World Energy Congress** co-hosted by the **World Energy Council** and the Netherlands **Ministry**

of Economic Affairs and Climate Policy and took place from 22-25 April 2024.

- This edition of the World Energy Council celebrates **100 years** since the Council's formation and the **first World Energy Congress held in London**.
- **Themed:** 'Redesigning Energy for People and Planet.'
- The World Energy Council has announced Riyadh, Saudi Arabia as the official host of the **27th World Energy Congress to be held 26-29 October 2026**.

About World Energy Council India:

- World Energy Council India is a **country member of World Energy Council (WEC)**, a global body established in **1923**, with the aim of promoting sustainable supply and use of energy.
- WEC India is **one of the earliest country members of the World Energy Council**, having joined the Council in **1924**.
- WEC India functions under the patronage of the **Ministry of Power, Government of India** and with the support of the **Ministries of Coal, New & Renewable Energy, Petroleum & Natural Gas and External Affairs**.

World Energy Council:

- The World Energy Council is the **world's oldest independent and impartial community** of energy leaders and practitioners.
- **Formed in 1923**, the Council is a **UN-accredited global energy body** that has convened diverse interests from across the full energy ecosystem for a century, and today has over **3,000 member organisations and a presence in nearly 100 countries**.

Scientists develop sodium battery that can be charged in seconds

News Excerpt:

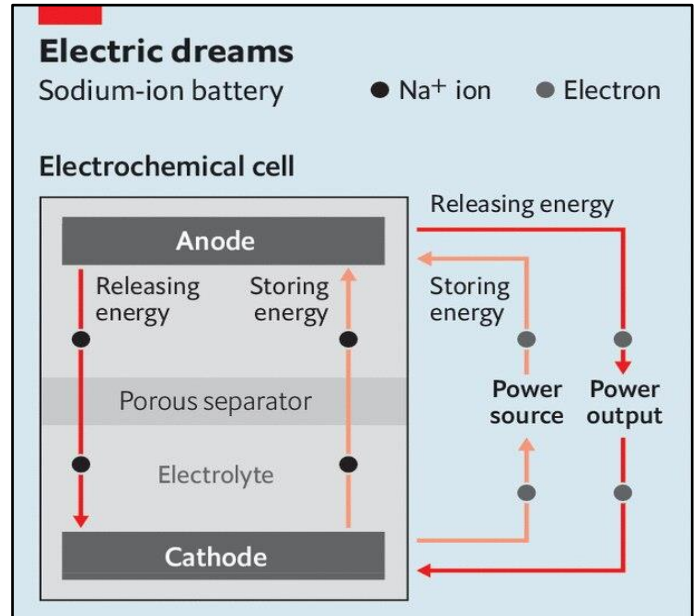
Researchers at the **Korea Advanced Institute of Science and Technology (KAIST)** have developed a **high-power hybrid sodium-ion battery** that can be charged in seconds.

More about the news:

- **South Korean** researchers **integrated anode materials** typically used in batteries with **cathodes** suitable for supercapacitors.
- The combination helped the battery to **achieve high storage capacities** and **rapid charge-discharge rates**.
- The study indicates that the battery can be a **viable next-generation** alternative to **lithium-ion batteries**.

Sodium ion battery:

- A **sodium-ion battery** is a type of **rechargeable battery** comparable to the ubiquitous lithium-ion battery, but it **uses sodium ions (Na+)** as the **charge carriers** rather than lithium ions (Li+).
- The **working principles** behind and cell construction of a sodium-ion battery is **virtually identical to those of lithium-ion batteries**, but sodium compounds are used instead of lithium compounds.



- Sodium-ion batteries are emerging as a potential alternative to current lithium-ion battery technology due to their lower cost, higher availability, and reduced environmental impact.

Ethylene Oxide contamination in Indian Spices

News Excerpt:

Hong Kong and **Singapore** have banned the sale of Indian spice brands **MDH** and **Everest** after authorities detected the presence of **ethylene oxide** in several **spice mixes**.

More about the news:

- The **Centre for Food Safety (CFS)** of **Hong Kong** announced that it has detected **ethylene oxide** in **three MDH products** – Madras Curry Powder, Mixed Masala Powder, and Sambhar Masala – and **Everest's Fish Curry Masala**.
- Samples were under **routine food surveillance** and **ethylene oxide**, which is **unsuitable for human consumption**, was found in multiple samples.
 - Hong Kong regulations prohibit the sale of food containing pesticide residues exceeding safe limits.
 - Following Hong Kong's lead, **Singapore's Food Agency (SFA)** also recalled **Everest's Fish Curry**

Masala due to exceeding permissible levels of ethylene oxide.

- In **2023, US Food & Drug Administration** recalled **Everest Sambhar Masala** and **Garam Masala** as samples tested positive for **Salmonella**. It advised consumers not to consume the products and destroy them.

Ethylene Oxide:

- **Ethylene oxide** is a **cancer-causing agent** that can raise the risk of **breast cancer**, as well as cause **damage to the DNA, the brain**, and the **nervous system** in humans.
- It is a **flammable colourless gas** at room temperature which is used primarily to **produce other chemicals**.
- Ethylene oxide is frequently reported to be associated with **lymphoma and leukaemia**.
- Ethylene oxide is also used as a **disinfectant, fumigant, sterilising agent** and **pesticide**.
 - The ability of ethylene oxide to **damage DNA** makes it an effective **sterilising agent** but also accounts for its **cancer-causing activity**.
- It is majorly used to **sterilise medical equipment** and to **reduce microbial contamination in spices**.
- The primary routes of **human exposure** to ethylene oxide are **inhalation** and **ingestion**, which may occur through **occupational, consumer, or environmental exposure**.

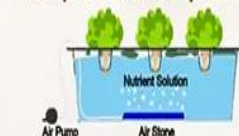
- It offers a **low-energy, safe alternative** to previous methods that relied on high voltage and non-biodegradable materials like **mineral wool**.
- It can **stimulate** the plant's **root system** and growth

HYDROPONIC SYSTEMS


Hydroponics is the art of gardening without soil. In the absence of soil, water goes to work providing nutrients, hydration, and oxygen to plant life. From watermelons to jalapeños to orchids, plants flourish under the careful regimen of hydroponics. Using minimal space, 90% less water than traditional agriculture, and ingenious design, hydroponic gardens grow beautiful fruits and flowers in half the time. This system fosters rapid growth, stronger yields, and superior quality. This system fosters rapid growth, stronger yields, and superior quality. When a plant is grown in soil, its roots are perpetually searching for the necessary nutrition to support the plant.

Six types of hydroponic systems

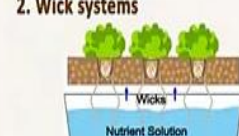
1. Deep water culture systems



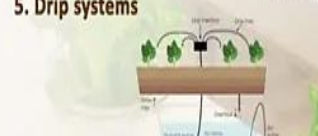
4. Ebb and flow systems




2. Wick systems



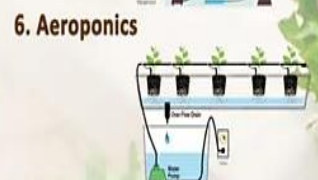
5. Drip systems



3. Nutrient film technique systems



6. Aeroponics



Electronic Soil - "eSoil"

News Excerpt:

Linköping University's study introduces an innovative **hydroponics method** using an **electrically conductive substrate** called "**electronic soil**" or "**eSoil**".

About e-soil:

- eSoil is based on the blend of the **conjugated polymer PEDOT: PSS** (poly(3,4-ethylenedioxythiophene): polystyrene sulfonate) and **carboxymethylated cellulose nanofibrils**.
- Its **active material** is an **organic mixed ionic electronic conductor**, while its **main structural component** is **cellulose**, the most abundant biopolymer.

environment in hydroponics settings.

Significance:

- eSoil consumes **little power**, and its main structural component is **cellulose**, the most abundant polymer.
 - This work opens the pathway for using physical stimuli to **enhance plant growth** but also provides a platform to understand better plant responses to **electric fields**.
- eSoil's low energy consumption and safety features, combined with the benefits of hydroponic cultivation, including **space efficiency** through **vertical farming**, present a sustainable solution to the **growing demands for food**.
- The research is a significant step toward **enhancing urban agriculture**.

India's first indigenous Fast Breeder Reactor at Kalpakkam.

News Excerpt:

The Prime Minister witnessed the commencement of "**core loading**" at India's first indigenous **Prototype Fast Breeder Reactor (PFBR)** (500 MWe) at **Kalpakkam, Tamil Nadu**.

More about the news:

- The **PFBR** has been fully designed and constructed indigenously by Bharatiya Nabhikiya Vidyut Nigam Limited (**BHAVINI**) with significant contributions from more than 200 Indian industries, including MSMEs.
- PFBR is an advanced **third-generation reactor** with inherent passive safety features ensuring prompt and safe plant shutdown in an emergency.

Bharatiya Nabhikiya Vidyut Nigam Limited (BHAVINI)

BHAVINI is a government company under the administrative control of the Department of Atomic Energy (DAE).

It was incorporated in **2003** with the objective of constructing and commissioning the first 500 MWe Fast Breeder Reactor (**FBR**) at Kalpakkam in Tamil Nadu.

Objective: To pursue the **construction, commissioning, operation and maintenance of subsequent Fast Breeder Reactors** for the generation of electricity in pursuance of the schemes and programmes of the Government of India under the provisions of the **Atomic Energy Act, 1962**.

BHAVINI has constructed a 500 MWe Prototype Fast Breeder Reactor (**PFBR**) at Kalpakkam.

The PFBR is the forerunner of the future Fast Breeder Reactors and is expected to provide **energy security** to the country.

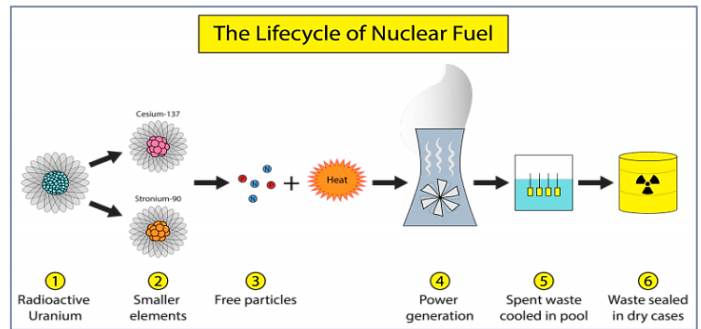
The PFBR is built with the design and technology developed at the **Indira Gandhi Center for Atomic Research (IGCAR)** located at Kalpakkam.

What is the Prototype Fast Breeder Reactor (PFBR)?

- The PFBR is a nuclear reactor that **produces more nuclear fuel than it consumes**.
- PFBR uses **fast neutrons** to generate more nuclear fuels than they consume while generating power, dramatically enhancing the **efficiency of the use of resources**.
- The Fast Breeder Reactor (FBR) will initially use the **Uranium-Plutonium Mixed Oxide (MOX) fuel**.
- PFBR uses **liquid sodium**, a highly reactive substance, **as a coolant**.
- Sodium absorbs fewer neutrons than light water, and more neutrons remain within the reactor.
- An increased number of neutrons causes a higher proportion of **Uranium 238** to convert into **Plutonium 239**, yielding **more plutonium than the original nuclear fuel**.
- FBRs are designed to **produce more plutonium than the uranium and plutonium they consume**.
- Since it uses the spent fuel from the first stage, FBR also offers a great advantage in significantly **reducing** the amount of **nuclear waste generated**, thereby avoiding the need for large geological disposal facilities.
- The **core-loading event of the PFBR** is being hailed as a "milestone" because the operationalisation of the PFBR will mark the start of **stage II** of India's **three-stage nuclear power programme**.

India's three-stage nuclear power programme:

- The **Department of Atomic Energy (DAE)** has planned the use of large deposits of **Thorium** available in the country as a long-term option.
- A three-stage nuclear power programme has been chalked out to use Thorium as a viable and sustainable option right at the inception of India's nuclear power programme.
 - In the **first stage**, India used **pressurised heavy water reactors (PHWRs)** and **natural uranium-238 (U-238)**, which contain minuscule amounts of **U-235**, as the **fissile material**.
 - The first stage produces **plutonium-239 (Pu-239)** and **energy**.
 - In **stage II**, India will use **Pu-239** and **U-238** in the **PFBR** to produce **energy, U-233**, and more **Pu-239**.
 - In **stage III**, **Pu-239** will be combined with **thorium-232 (Th-232)** in reactors to produce **energy and U-233**.



- The **three-stage nuclear power programme** aims to **multiply the domestically available fissile resource** through the use of natural Uranium in Pressurized Heavy Water Reactors, followed by the use of Plutonium obtained from the spent fuel of Pressurized Heavy Water Reactors in Fast Breeder Reactors.

Nuclear waste and its treatment

News Excerpt:

India recently advanced its nuclear program by loading the core of the **Kalpakkam PFBR**, nearing **stage II** of its nuclear programme. With **stage III** aimed at utilizing thorium reserves for energy, India faces the challenge of effective nuclear waste management amidst its nuclear power expansion.

What is nuclear waste?

- Nuclear waste refers to the **radioactive materials** produced during **nuclear reactions** in **nuclear power plants, research reactors, nuclear weapons production, and other nuclear processes**.
 - In a fission reactor, neutrons bombard the nuclei of atoms of certain elements. When one such nucleus absorbs a neutron, it destabilises and breaks up. This process produces energy and creates nuclei of different elements.

- For example, when the **uranium-235 (U-235)** nucleus absorbs a neutron, it can fission to **barium-144, krypton-89**, and three neutrons. If the 'debris' (**barium-144 and krypton-89**) constitute elements **that can't undergo fission, they become nuclear waste.**
- Nuclear waste is highly radioactive and needs to be stored in facilities reinforced to prevent leakage into and contamination of the local environment.
- Apart from the byproducts from nuclear fission reaction nuclear waste can come in various forms, including **spent nuclear fuel rods, contaminated equipment and materials.**

NSOIM

News Excerpt:

The **India International Science Festival (IISF)** is set to host the **National Social Organisations and Institutions Meet (NSOIM).**

More about NSOIM:

- It was held from January 17 to January 19, 2024, at the DBT-THSTI-RCB (Department of Biotechnology-Translational Health Science and Technology Institute-Regional Centre for Biology) Campus in **Faridabad, Haryana.**
- It has been a national **platform for bringing together all the stakeholders who believe in the transformative power of science, technology, and innovation for societal good.**
- NSOIM is where science meets society, and innovation catalyzes grassroots development.
- The central **theme** for NSOIM-2023 is '**Technological Innovations for Grassroots Development**'. and it will encompass the following **sub-themes**:
 - Grassroot Innovations for Livelihood Generation.
 - Addressing emerging societal challenges.
 - Water and environmental conservation, management and security.
 - Food and Nutrition Solutions for a healthy society.
 - Livelihood-Centric S&T Systems for Multidimensional Poverty Alleviation.

Objectives of NSOIM-2023:

- Encourage **developing and disseminating innovative solutions** that enhance **livelihood opportunities** at the grassroots level.
- Highlight the **role of cutting-edge research, education, and information dissemination in tackling contemporary societal issues.**

India International Science Festival (IISF)

- IISF is a flagship event that brings together the brightest minds, scientists, researchers, and innovators to celebrate the spirit of science.

- It is a collaborative endeavour between the **Ministry of Science and Technology, Ministry of Earth Sciences, Department of Space and Department of Atomic Energy in partnership with Vijnana Bharati** - a science movement spearheaded by scientists of the nation with swadeshi spirit.
- The main purpose of IISF is the **celebration of science by all.**

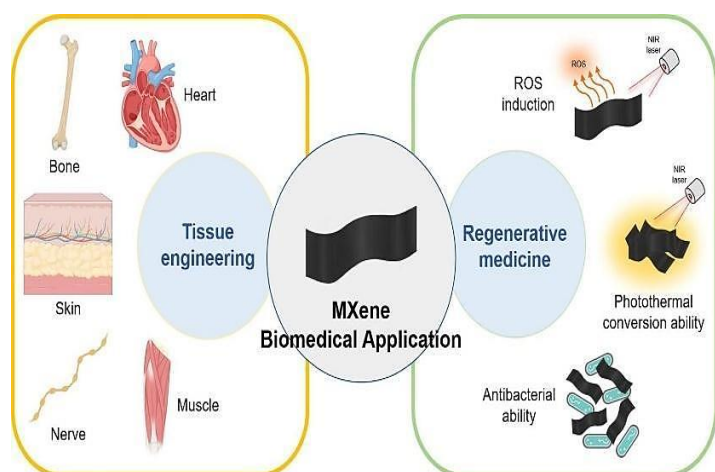
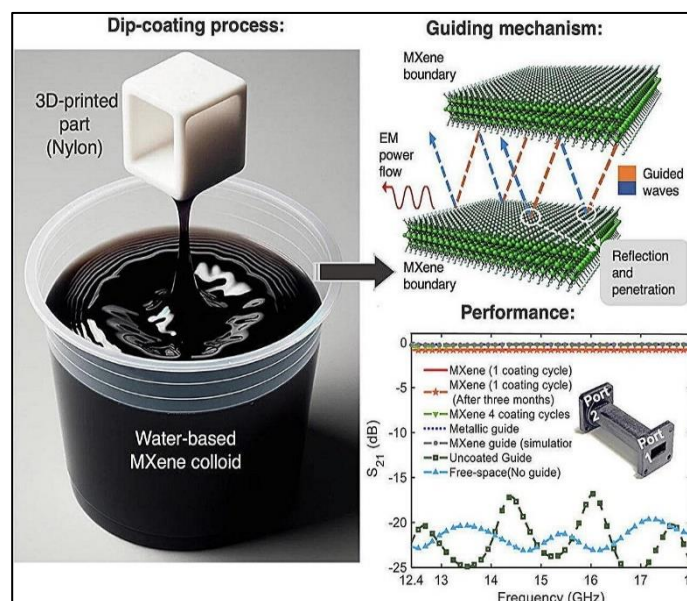
MXenes-coated devices can guide microwaves in space.

News Excerpt:

Researchers from Drexel University and the University of British Columbia are trying to **lighten the load of Waveguide** by **creating and testing a waveguide made from 3D-printed polymers coated with a conductive nanomaterial called MXene.**

About MXene material:

- MXene is an **inorganic compound** made up of atomically thin layers of **transition metal carbides, nitrides or carbonitrides.**



- MXene materials provide one of the **thinnest possible coatings**.
- Their **flakes** are a **few atoms thick** and can **create a conductive surface**, so they have great potential in using MXenes to treat additive manufactured components made of polymers with complex shapes.
- It is **highly conductive**, functions as an **electromagnetic shield**, and can be **produced** simply by **dipping the Waveguide in MXenes dispersed in water**.
- The **MXene-coated nylon waveguides weigh about eight times less than the standard aluminium** ones currently being used.
- The waveguides are typically made from metals like silver, brass, and copper. **In satellites, aluminium is the lighter-weight choice.**

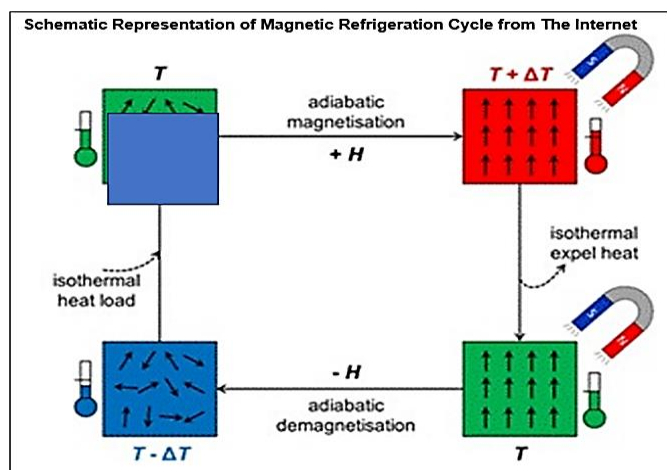
Magnetic Refrigeration

News Excerpt:

Researchers have found a new alloy (**Heusler alloys**) that can act as an effective magnetic refrigerant and an alternative cooling agent for minimizing greenhouse gas emissions and meeting the global demand for higher energy efficiency to tackle global warming.

About Magnetic Refrigeration:

- Magnetic refrigeration offers an **energy-efficient** and **environment-friendly cooling technology** as an **alternative to the current vapour-cycle refrigeration technology**.
- **Magnetic cooling effect (MCE)** is the **reversible temperature change of a magnetic material** when subjected to an externally applied magnetic field.
- In the magnetic refrigeration cycle, a magnetic field is applied to the magnetic material under an **adiabatic process** where randomly oriented magnetic moments align along the external magnetic field, heating the magnetic material.
 - This heat is transferred from the material to the ambience. When the magnetic field is removed during adiabatic demagnetization, the magnetic



moments of the material become randomized, resulting in a decrease in temperature below the ambient temperature.

- **This process causes the material to absorb heat from the surrounding heat-transfer medium.**

Properties required for new magnetic materials:

- The material must be **capable of operating for millions of cycles without any fatigue and failure**.
- The material must have **high thermal conductivity**.
- The material should **respond to an external magnetic field of about 2 T (Tesla)**, which permanent magnets can generate.

About Heusler alloys:

- A team at S.N. Bose National Centre for Basic Sciences, an autonomous institute of the Department of Science and Technology (DST), experimented with a certain type of alloy called **all-transition metal-based Heusler alloys (magnetic intermetallics with a face-centred cubic crystal structure)** in their search for material exhibiting **giant reversible MCE (MagnetoCaloric Effect)**.
- **Ni (Co)-Mn-Ti Heusler system exhibits multifunctional properties with ultrahigh mechanical stability** because of their intrinsic **d-d hybridization**.

E Ink Displays

News Excerpt:

In recent times, e-books have become common for reading, and with the use of e-books, 'E Ink' has also come to light. Despite its advantages, E Ink still hasn't conquered all our screens, and e-readers are a pleasure to read on with their crisp, paper-like screens.

What are E Ink displays, and how do they work?

- E Ink displays are a **special type of screen technology** often used by e-readers like Amazon Kindle.
- The technology was **originally developed at MIT in the 1990s** and is now **owned by E Ink Corporation**.
- The screens **use tiny microcapsules filled with positively charged white particles and negatively charged black ones suspended in the fluid inside the display**.

Uses of E Ink displays:

- E Ink displays were very popular among all e-readers in the 2000s.
 - **Kindle and Kobo** e-readers still use E Ink displays.
- E Ink is used at **bus stop displays, walking direction signs, and restaurant menu boards**.

C-bot

News Excerpt:

The Goa-based CSIR-National Institute of Oceanography (NIO) has launched an autonomous underwater vehicle

called **C-bot**, a robot with advanced features for increased surveillance over the coral reefs.

About the C-bot:

- This robot is the **first step to building a capable underwater vehicle** that can scan the depth of the Indian Ocean.
 - The vehicle can **travel to a depth of 200 metres underwater**.
- It will help maintain **surveillance over the coral reefs in the ocean**.
- With different sensors and different cameras, **the robot measures the parameters and might help explain why the corals are dying the way they are**.
- Besides helping researchers, the C-bot will also **help the Indian Navy perform bathymetry studies to help plot navigation channels and scope out hydrothermal vents**, where geothermally heated water seeps up from deep below the ocean floor.
 - Bathymetry **studies the "beds" or "floors" of water bodies, including the ocean, rivers, streams, and lakes**.
- The robot will also help **find the active hydrothermal vents emitting many elements into the ocean and active biology**, which is going on in many places, like in many extreme environments where the temperature is 400-500 degrees Celsius.
- The vehicle can **send real-time data and photographs**, which will help researchers with their studies.



- In biology, **tropism** indicates an organism's growth or turning movement, usually a plant, in response to an external environmental stimulus.

About FiloBot: Nature-inspired robot that can revolutionize robotics:

- **FiloBot** differs from conventional climbing robots as it **doesn't depend on pre-programmed movements**.
 - It instead absorbs **3D printing filament** through its head and extends its length over time, just like a creeper.

Other innovations and their significance:

- A similar innovation was led **at the University of Toronto Mississauga**, where the team has been working on developing **snake-like robots that can be utilized in medical surgeries**.
- These robots are designed to be slender, flexible and extensible hands that could enable doctors to access difficult-to-reach places within the human body, offering a significant advancement in medical procedures.
- If these robots are developed to their full potential, they can **revolutionize the medical field by navigating intricate paths around vital tissues**, making previously inoperable cases feasible.
- The development extends to semi-autonomous models, which, guided by surgeons, could use sensors to avoid obstacles, enhancing the precision and safety of surgeries.
- **NASA's Jet Propulsion Laboratory (JPL)** unveiled a similar snake-like robot, specifically crafted to work on rough terrains of our solar system's planets and moons.
- **Exobiology Extant Life Surveyor (EELS 1.0)** robot is engineered to navigate diverse landscapes, including ice, sand, cliff walls, deep craters, and lava tubes.

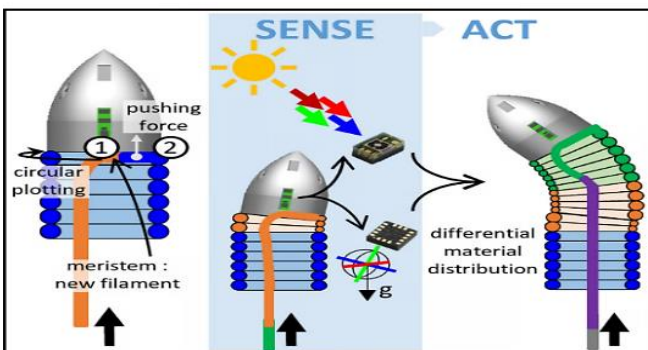
FiloBot

News Excerpt:

A new innovative **plant-inspired robot named FiloBot** has been developed to climb up structures just like vines.

About the news:

- This new innovation team utilizes a combination of plant behaviours like **phototropism, negative phototropism, and gravitropism**, which are naturally occurring behaviours in high-tech robots.



India's First Hypervelocity Expansion Tunnel Test Facility

News Excerpt:

A crucial milestone has been achieved with **India's first Hypervelocity Expansion Tunnel Test Facility, which was successfully established and tested** by the Indian Institute of Technology, Kanpur (IITK).

About the test facility:

- The Facility, named **S2**, can generate flight speeds between 3-10 km/s, simulating the hypersonic conditions encountered during atmospheric entry of vehicles, asteroid entry, scramjet flights, and ballistic missiles.
- **The S2, nicknamed 'Jigarthanda'**, is a 24-meter-long facility located at IIT Kanpur's **Hypersonic Experimental Aerodynamics Laboratory (HEAL)** within the Department of Aerospace Engineering.

- The S2 was **indigenously designed and developed** over three years with funding and support from the Aeronautical Research and Development Board (ADRB), the **Department of Science & Technology (DST) and IIT Kanpur**.
- It was indigenously designed and developed and is a valuable test facility for **ISRO and DRDO's ongoing missions**, including Gaganyaan, RLV, and hypersonic cruise missiles.

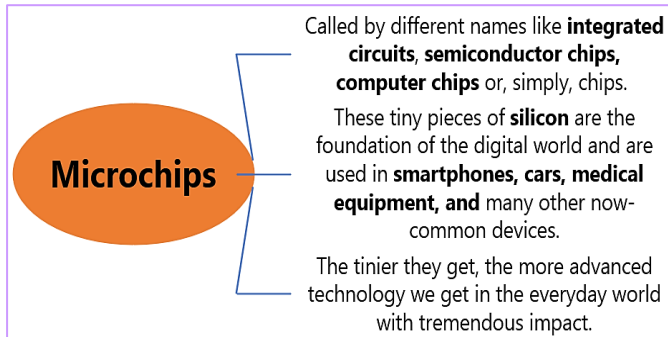
Significance of this facility for India:

- Hypersonic research Facility will **enable more aerospace engineers** and researchers to pursue hypersonic research.
- The research activities and **data generated** in the facility will serve **as input for the optimization of existing vehicles** and futuristic defence and Space Missions.
- The establishment of such a facility will **position India globally for advanced experimental hypersonic research**.

A new machine to power the future of semiconductor innovation

News Excerpt:

Netherland-based **Advanced Semiconductor Materials Lithography (ASML)** has unveiled its new '**High NA EUV**' machine to manufacture the most advanced semiconductor chips.



Science of Semiconductor Chip Manufacturing-Lithography:

- We have powerful computers almost everywhere around us thanks to a technology called **semiconductor lithography**.
 - **Lithography** is the process of **using light to print tiny patterns on silicon**.
 - It is a fundamental step in mass-producing microchips.

Principles of lithography:

- A lithography system is essentially a **projection system**.
- **Light is projected** through a blueprint of the pattern that will be printed (known as a 'mask' or 'reticle').

- With the pattern encoded in the light, the system's optics shrink and focus the pattern onto a **photosensitive silicon wafer**.

EUV lithography:

- EUV stands for **extreme ultraviolet**, an **incredibly short wavelength** of light that ASML generates in large quantities to print small, complex designs on microchips.
- EUV lithography does big things on a tiny scale.
- **ASML** is the **only maker of extreme ultraviolet (EUV) lithography machines**, needed to manufacture the most advanced chips.
 - **High NA EUV** is the **next generation** of that technology.

High NA EUV:

- In the late **2010s**, the **ASML** became the **first and only company** to market a lithography tool using EUV, or **13.5 nanometre wavelength light**.
- In February, 2024, ASML unveiled its new '**High NA EUV**' machine.
 - It costs \$350 million (Rs 2,900 crore) apiece and is as big as a double-decker bus.
 - This machine uses **extreme ultraviolet (EUV) photolithography**, a next-generation technology, to make semiconductors. The mould of the circuits of a transistor are transferred to a silicon wafer coated with a light-sensitive material called a **photoresist**.
 - Both the original and High NA machines create EUV light by **vaporizing droplets of tin with twin laser pulses 50,000 times a second**.
- The **High NA tool** will let chipmakers **shrink the size** of the smallest features on their chips by **up to 40%**, allowing the **density of transistors to nearly triple**.
- The High NA machine's biggest change is a **larger optical system** consisting of **irregularly shaped mirrors**, made by **Carl Zeiss**, polished so smooth they must be kept in a vacuum.
 - They collect and focus lighter than their predecessors - High NA stands for **high numerical aperture** - which leads to better resolution.

Antihydrogen experiment

News Excerpt:

An international team of physicists from the **Anti-hydrogen Experiment: Gravity, Interferometry, Spectroscopy (AEGIS)** collaboration has achieved a breakthrough by demonstrating the **laser cooling of Positronium**.

What is Positron:

- Positronium is a fundamental atom that comprises an electron (e^-) and a positron (e^+). Electrons and positrons are leptons. They interact through **electromagnetic and weak forces**.
- Due to its very short life, it annihilates with a **half-life of 142 nano-seconds**.

Leptons:

- Leptons are said to be **elementary particles**; that is, they do not appear to be made up of smaller units of matter.
- Leptons can either carry one unit of electric charge or be neutral.
- The charged leptons are the **electrons, muons, and taus**.
- Each of these types has a **negative charge and a distinct mass**.
- Leptons respond only to the electromagnetic force, weak force, and gravitational force and are **not affected by the strong force**.

Antihydrogen Experiment: Gravity, Interferometry, Spectroscopy (AEGIS) collaboration.

- The experiment was performed at the **European Organization for Nuclear Research, more popularly known as CERN, in Geneva**.
- This is an important precursor experiment to the formation of anti-hydrogen and the measurement of Earth’s gravitational acceleration on antihydrogen in the AEGIS experiment.
- In addition, this scientific feat could open prospects to produce a gamma-ray laser that would eventually allow researchers to look inside the atomic nucleus and have applications beyond physics.

Science Based Targets Initiative (SBTi)

News Excerpt:

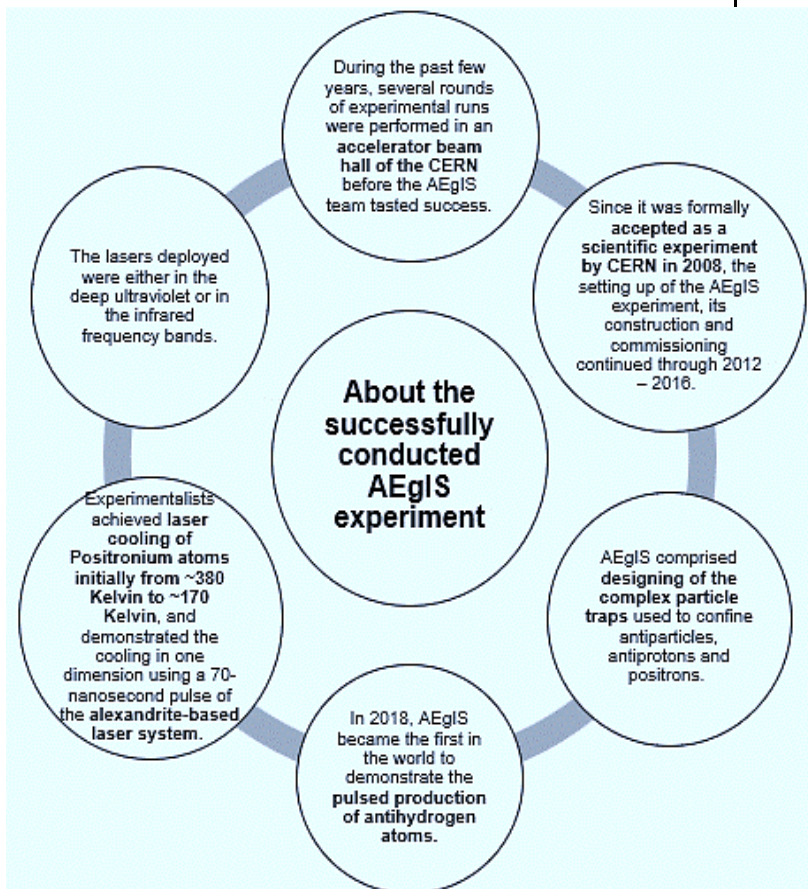
A **disputed recent decision** by the Science Based Targets Initiative (SBTi) to **allow carbon offsetting for Scope 3 emissions** of enterprises with SBTi-based climate targets has sparked **debate and scepticism**.

- **The New Climate Institute's analysis** shows that if the **Beta Scope 3 Flexibility Claim** is considered, companies like **Apple and H&M Group** would only need to **reduce emissions by 20% and 2%, respectively**.

Other companies would no longer need to reduce emissions; companies like Mercedes-Benz, Volkswagen Group, and Deutsche Post DHL could increase their emissions covered.

About Science Based Targets Initiative (SBTi):

- SBTi is essentially a **standards-setting body for corporate climate targets**.
- It also **reviews climate targets** that large companies have set against its given framework and validates those that meet its stringent criteria.



- Its mass is twice the electron mass and enjoys the unique distinction of being a **pure leptonic atom**.
- This hydrogen-like system, with **halved frequencies for excitation**, makes it a **great contender for attempting laser cooling** and thereby performing tests of fundamental theories in physics.
- A usual atom is made up of a mixture of baryons and leptons. Since Positronium is only made up of electrons and positrons, and no usual nuclear matter, it has the unique distinction of being a purely leptonic atom.

About the Experiment:

- The experiment was conducted by **19 European and one Indian research group** comprising the

Scope 3

Its emissions are all the **indirect emissions stemming from a company's value chain**, including **emissions from suppliers and customers**.

While excluding **direct emissions from the company's own operations**, which are **Scope 1 emissions**, and **indirect emissions from purchased electricity**, which are **Scope 2 emissions**.

For example, **automobile industry**, emissions from the **production of components by suppliers**, transportation of raw materials, vehicle use by customers, and disposal of end-of-life vehicles.

Its emissions are **difficult to measure**; their nature varies widely from sector to sector, making it often **challenging to measure and report all relevant emissions**.

Its emissions disproportionately represent the **largest quantity of a company's emissions**.

- It **guides businesses** in **setting greenhouse gas (GHG) emission reduction targets** through what is called '**Science-Based Targets**' (SBT), which are based on the standards, tools, and guidance developed by the initiative.
- Over **4,000 global big and small companies** have set SBTs based on **SBT's guidance**, including **Indian companies** such as those in the **Tata Group, Mahindra Group, Adani Group and Wipro**.
- SBT's frameworks have evolved into the most widely adopted standard for corporate climate action over the years.

3-D map of the universe hints about dark energy

News Excerpt:

Scientists have known that our universe is expanding at an increasingly faster pace. They believed that 'dark energy' is causing this expansion, but little is known about it. This may change soon.

Key points about the Dark Energy Spectroscopic Instrument (DESI):

- DESI is a unique instrument with 5,000 robotic 'eyes', i.e. the capability to observe 5,000 galaxies simultaneously, each capable of separately capturing and processing light from galaxies.
- It is mounted on the Nicholas W. Mayall 4-meter Telescope at the **Kitt Peak National Observatory in Arizona, USA**.
- It has been operating for **three years** and is scheduled to **continue for at least two more years**.
- Data from **the first year of DESI observations**:
 - It captures light from 6 million galaxies, some of which existed as far back as 11 billion years ago,
 - It has been used to create the most comprehensive **three-dimensional evolutionary map of the universe to date**.
- Using **the first year's observational data**:
 - The DESI collaboration has calculated that the **speed of expansion of the universe is increasing** at a rate of 68.5 km per second after **every 3.26 million light-years of expansion**.
- Some of the calculated values from DESI's observations are not consistent with current well-established theoretical models that describe the universe very well.

Dark energy:

- Dark energy is causing **the universe to expand more rapidly over time**.
 - It is considered a constant in the leading model of cosmology.

India's PRATUSH

News Excerpt:

Astronomers are looking forward to opening a new window on the universe by posting high-resolution telescopes on the moon, and in orbit around it.

- One of the proposals is from India called PRATUSH.

About PRATUSH (Probing Reionization of the Universe using Signal from Hydrogen)

- PRATUSH is a **future radiometer** in **lunar orbit** that will reveal the **Cosmic Dawn of our Universe**.
- It is being built by the **Raman Research Institute (RRI)** in Bengaluru with active collaboration from the **Indian Space Research Organisation (ISRO)**.
- **ISRO will place PRATUSH into orbit around the earth**. After some fine-tuning, the space agency will launch it moon wards.
- Although earth orbit will have significant **radio frequency interference (RFI)**, it will have advantages compared to ground-based experiments, such as operating in free space and lesser ionosphere impact.
- PRATUSH in lunar orbit will have the **ideal observing conditions operating in free space** with **minimal RFI** and **no ionosphere** to speak of.
- It will carry a **wideband frequency-independent antenna**, a **self-calibrating analog receiver** and a **digital correlator** to **catch radio noise** in the all-important signal from the Dark Ages.

Significance of PRATUSH:

- PRATUSH will **answer the question** of when the **first stars formed** in our universe, the **nature of the first stars**, and **what was the light from the first stars** or, in other words, **the colour of the light of Cosmic Dawn**.
- PRATUSH will be the **pioneering space telescope** that will reveal, for the first time, the **history of our infant Universe** as it **transformed after the Big Bang - from cold gas into stars and galaxies** and the universe as we know it today.
- PRATUSH will inform us of the first rays of the first Sun in the infant universe.

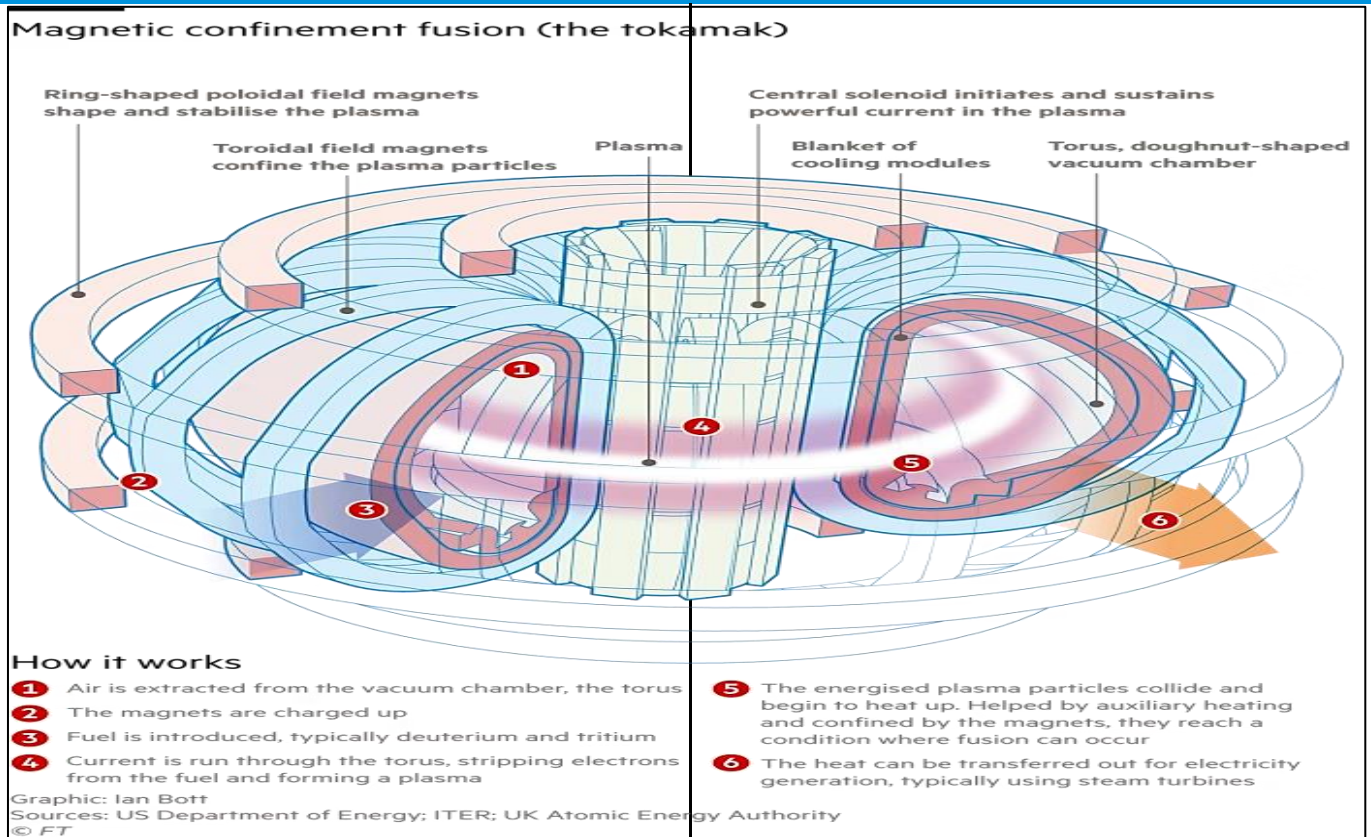
'Artificial Sun' reaches a temperature of 100 million Celsius

News Excerpt:

Scientists from South Korea have been able to produce heat of 100 million Celsius from their reactor for a record period of 48 seconds.

More About the News:

- The **Korea Institute of Fusion Energy's (KFE) Korea Superconducting Tokamak Advanced Research (KSTAR)** fusion reactor has achieved a



groundbreaking milestone by **reaching temperatures seven times hotter than the Sun's core.**

- This accomplishment demonstrates progress towards **sustaining high-temperature plasma, which is crucial for nuclear fusion reactions.** Maintaining the **high confinement mode (H-mode) for over 100 seconds** further showcases KSTAR's capabilities.
- **H-mode** provides a **stable plasma state** essential for efficient fusion reactions. By employing tungsten diverters instead of carbon, the KSTAR team successfully extended plasma stability.

Key terms:

- **Tokamak:** A tokamak is a **device used to confine and control hot plasma in the process of nuclear fusion.** It consists of a **torus-shaped chamber surrounded by magnetic coils.**
- **Tungsten diverters** are critical components in fusion reactors, as they expel waste gases and impurities while enduring high surface heat loads.
 - Earlier the Carbon diverters were used but with the coming of tungsten diverters there is a **25% increase in Surface temperatures** ultimately enhancing the reactor's operational capabilities.
- **Artificial Sun:** The term is used to **describe tokamak reactors because they replicate the conditions found in the Sun's core where nuclear fusion naturally occurs.**

Negative Leap Second

News Excerpt:

The melting of **polar ice** due to global warming is affecting Earth's rotation and could impact **precision timekeeping**, according to a paper in the journal Nature.

Making the leap:

- The establishment of **two versions of time — astronomical and atomic** came more than **55 years** ago when **atomic clocks were adopted as the official time standard.**
- In the early **1970s**, Earth was slowing down in its rotation, and a gap formed between atomic time and astronomical time. **Astronomical time fell behind atomic time by 2.5 milliseconds every day.**
 - Thus, the "leap second" was born to adjust that the "day" was **getting longer.**

What is a Leap Second?

- Coordinated Universal Time (UTC) is based on International Atomic Time (TAI) but is adjusted by seconds to **account for the difference between the definition of the second and the rotation of the Earth.**
- Occasionally, 1s is added to the UTC time scale. **This second is called a leap second.**
- Its purpose is to keep the UTC time scale **within ±0.9 s of the Universal Time (UT1) time scale**, which changes slightly due to variations in the rotation of the Earth. **UT1 refers to astronomical time.**

- **Twenty-seven leap seconds have been added** to Universal Coordinated Time since 1972.
- The addition of a leap second happens at the last tick of the clock on the night of Dec. 31 or June 30.
- In a **leap second**, instead of 11:59 and 59 seconds turning to midnight, there is another second at 11:59 and 60 seconds.

Small-scale LNG as fuel for India

News Excerpt:

Recently, the Union Ministry of Petroleum and Natural Gas dedicated to the nation India's **first small-scale liquefied natural gas (SSLNG) unit at GAIL (India) Ltd's Vijaiapur complex in Madhya Pradesh.**

Why small-scale LNG?

- The government **aims** to increase the **share of natural gas in its primary energy mix to 15% by 2030** from a little more than 6% at present.
- Natural gas is **far less polluting** than conventional hydrocarbons like coal and oil.
- It is also **cheaper than oil**, more than 85% of India's requirement for which is met through costly imports.
- Natural gas is seen as a **key transition fuel** in India's journey **towards green energy and future fuels.**

Why is the use of LNG in long-haul trucks and buses attractive?

- **LNG is significantly cleaner** than diesel- with **reduced carbon dioxide emissions and negligible amounts of particulate matter, nitrogen oxide, and sulphur dioxide emissions.**
- **LNG offers a slightly longer range to vehicles than diesel** with similar-sized fuel tanks and is usually **cheaper than crude oil**, from which diesel is derived.
- Although **India imports around half of its natural gas requirement, this dependency level is much lower than that for crude oil.**
 - Replacing a major chunk of India's diesel consumption by LNG could lead to **substantial foreign exchange savings.**
- LNG has been **used successfully and aggressively in medium and heavy commercial vehicles in many countries, most notably in China.**

What is SSLNG?

SSLNG refers to the liquefaction and transportation of natural gas using unconventional means in a significantly smaller-scale operation than the usual large-scale liquefaction, regasification, and transportation infrastructure and processes.

LNG - gas in its liquid or super-chilled form - is supplied in specialised trucks and small vessels to industrial and commercial consumers in regions that are not connected by pipelines.

The SSLNG chain can start from a large-scale LNG import terminal from where the LNG can be transported to consumers by cryogenic road tankers or small vessels instead of being regasified and supplied through pipelines.

• The chain can also start at locations with ample natural gas supply or production, where small liquefaction plants can be set up.

HEALTH

Ayurveda, Siddha and Unani Chapter in ICD

News Excerpt:

Recently, the data and terminology relating to diseases based on Ayurveda, Siddha and Unani Medicine have been included in the WHO **International Classification of Diseases ICD-11** classification.

- With this effort, the terminology defining diseases in Ayurveda, Unani and Siddha medicine has been indexed as a code and included in the WHO Disease Classification Series ICD-11.
- The data and terminology relating to diseases based on **Ayurveda, Siddha, and Unani (ASU)** systems will now be included in the WHO's ICD11 classification.

About ASU:

Ayurveda, Siddha and Unani drugs, **mainly poly-herbal/herbo-mineral preparations**, are very different from synthetic molecules of the allopathic system, which are produced under controlled laboratory conditions.

- It depends on the quality and availability of raw materials of botanical origin.
- Keeping this in view, the **National Medicinal Plants Board (NMPB) was established in 2000** with the objective of **in-situ conservation and ex-situ cultivation** of quality raw medicinal plant materials.
- The government has taken several legislative and administrative measures to regulate the manufacture and sale of Ayurveda, Siddha and Unani (ASU) drugs.
 - A separate **Chapter IVA**, regulates the manufacture and sale of **ASU medicines in the Drugs & Cosmetics Act of 1940.**

India is deploying atomic clocks across the country to ensure that the **time shown in our digital watches, smartphones, and laptops** is truly based on **Indian Standard Time (IST).**

Background:

- So far, **India** has **atomic clocks** in **Ahmedabad** and **Faridabad**, and more are being installed in **Bhubaneswar, Jaipur, and Hyderabad.**
- **Only four other countries - the US, the UK, Japan, and Korea** - have their **own atomic clocks.**

About Atomic Clock:

- An **atomic clock works like a conventional clock.** Still, the **time-base of the clock**, instead of being an oscillating mass as in a pendulum clock, is **based on the properties of atoms** when **transitioning between different energy states.**
- An atom, when excited by an external energy source, goes to a higher energy state. Then, from this state, it goes to a lower energy state. In this transition, the atom releases energy at a very precise frequency, which is characteristic of the type of atom.

Key Points:

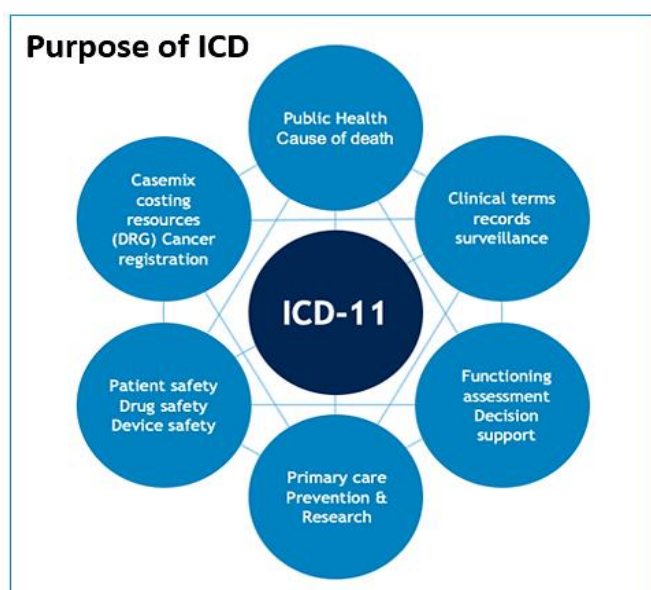
- The Ministry of AYUSH, in collaboration with the World Health Organization, has prepared a classification of diseases used in Ayurveda, Siddha and Unani systems under the **TM-2 module of the ICD-11 series**.
- ASUs have been added to the International Classification of Diseases (ICD).
 - The World Health Organization (WHO) has developed an **International Classification of Diseases (ICDs)** classification series to classify diseases internationally.
- **Infectious diseases** like Malaria and lifestyle diseases like chronic insomnia are included in this classification.

India's steps in this manner:

- **Central Bureau of Health Intelligence (CBHI)** is an agency under the Ministry of Health and Family Welfare that serves as the WHO Collaboration Centre for ICD-related activities.
 - It facilitates the collection and dissemination of data on various diseases and mortality.
- The **Ministry of Ayush has already developed the Code** for Ayurveda, Siddha, and Unani Medicine through the **National Ayush Morbidity and Standardized Electronic Portal (NAMSTE)**.

About ICD:

- **ICD serves a broad range** of uses globally and provides critical knowledge on the extent, causes and consequences of human disease and death worldwide via data that is reported and coded with the ICD.
- Clinical terms coded with ICD are the main basis for health recording and statistics on disease in primary, secondary and tertiary care, as well as on cause of death certificates.
- The International Classification of Diseases (ICD) has been the basis for comparable statistics on causes of mortality and morbidity between places and over time.



India As a Market of Generic Drugs

News Excerpt:

Janaushadhi Kendras is at the centre of a rising wave of non-branded generic medicines that could be replicated in other countries.

About Generic Drugs in India:

- **Definition:** A non-branded medicine that, with respect to dosage, is equivalent to a branded or reference-listed drug, administration, and effectiveness is known as a generic medication.
 - Generic drugs, copies of innovator medicines, are made once the patent ends.
- **India** is primarily a branded generic drugs market, where several pharma companies sell their own brands of generic molecules.
- The **Food and Drug Administration (FDA) regulations**, include the same active component as the brand name medication and the same dose, potency, safety, usage circumstances, and mode of administration.
 - **For example**, the paracetamol molecule can be bought in the market as **Calpol, Crocin, Dolo and other trade names**.
- **Usefulness:**
 - Usually, 90-95 per cent less expensive than branded medicine,
 - Prove to be safe and effective,
 - Easily available,

Both generic and branded medications are governed by the Drugs and Cosmetics Act of 1940.

Position of Generic Medicine in India:

- India is the **third-largest country in terms of volume and the fourteenth largest in terms of value in the pharmaceutical sector** because of the idea of using traditional medicine.
- India has risen to the top in the world's **supply of DPT, BCG, and measles virus vaccinations**. Indian medicine is preferred worldwide, thus making India the **"pharmacy of the world"**.

About Pradhan Mantri Bhartiya Janaushadhi Pariyojana (PMBJP):

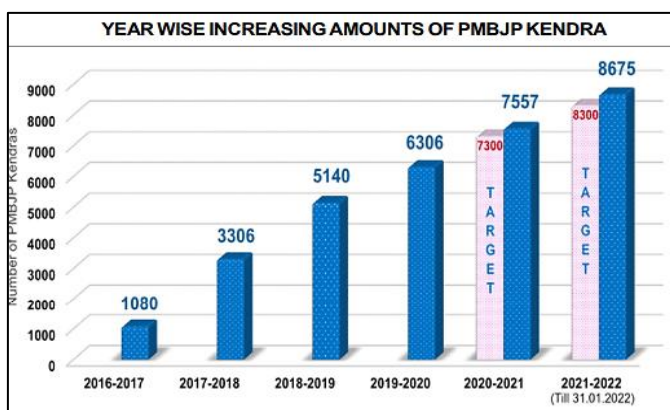
- To make quality generic medicines available at affordable prices to all, PMBJP was launched by the **Department of Pharmaceuticals, Ministry of Chemicals & Fertilizers, Government of India, in November 2008**.
- The Scheme is implemented by a society registered under the **Societies Registration Act**, viz., **Pharmaceuticals and Medical Devices Bureau of India (PMBI)**.
- **Objective:**
 - Ensure **access to quality medicines** for all sections of the population, especially the poor and the deprived ones.

- Create **awareness** about generic medicines through education and publicity to counter the perception that quality is synonymous with high prices only.
- Generate **employment** by engaging individual entrepreneurs in the opening of PMBJP Kendras.
- **Under the Scheme**, dedicated outlets known as **Janaushadhi Kendras** are opened to provide generic medicines at affordable prices.

Janaushadhi Kendras:

In India, Janaushadhi Kendras sell generic drugs that are priced 50 to 60 per cent lower than the popular brands.

- The rapid expansion of the Kendras provides livelihoods and plays a critical role in saving out-of-pocket expenditures for patients.
 - An estimated **1 million to 1.2 million people**, on average, buy medicines every day from Janaushadhi Kendras across India.
 - During FY23, the PMBI sold Janaushadhi medicines worth Rs 1,236 crore, which led to savings of Rs 7,416 crore for citizens.



Antibiotics Survey by NCDC

News Excerpt:

Over half of the almost 10,000 hospital patients surveyed recently were given antibiotics to prevent infection rather than treat it amidst **growing concerns about the rise in antibiotic resistance**.

Key Highlights of the survey:

- Out of 11,588 admissions and 9,652 eligible patients, **72% were prescribed antibiotics**.
- As the NCDC survey notes, one of the main drivers for **developing antibiotic resistance is the excessive and inappropriate use of antibiotics**.
- Using the **WHO's Access, Watch and Reserve (AWaRe) classification**, it was found that **only 38% of the prescriptions were for antibiotics belonging to the Access group**, which "offer the best therapeutic value while minimizing the potential for resistance".

National Centre for Disease Control:

- The NCDC is the **nodal agency for India's national programme on AMR containment**, one of the key

components of which is the surveillance of antibiotic usage.

- To achieve this goal, it has established the **National Antibiotic Consumption Network (NAC-NET)**, through which network sites **compile data on antibiotic consumption in their respective health facilities** and send it to the NCDC.

IISc Bengaluru introduces warm Vaccine against current strains of SARS-CoV-2

News Excerpt:

A heat-tolerant vaccine developed by the IISc researchers is said to be effective against all current strains of SARS-CoV-2 and **can be quickly adapted for future variants as well**.

Past Development:

- Since the beginning of the COVID-19 pandemic, researchers have been working on developing a heat-tolerant vaccine that can offer protection against different strains of **SARS-CoV-2 – both current and future variants**.
- Researchers have reported the design of a synthetic antigen that can be manufactured as a potential COVID-19 vaccine candidate.

The process applied in inventing Vaccine:

- After analyzing various proteins found in the virus, the researchers selected two parts of SARS-CoV-2's spike protein – **the S2 subunit and the Receptor Binding Domain (RBD)** – for designing their vaccine candidate.
- The S2 subunit is **highly conserved and mutates much less** than the S1 subunit, which is the target of most current vaccines.

Nematocyst: a cellular weapon

News Excerpt:

A jellyfish uses the nematocyst to have painful and sometimes deadly effects.

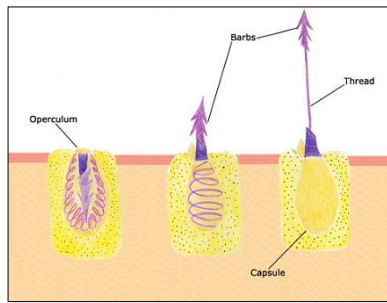
About the Nematocyst:

- The natural world boasts **diverse defence mechanisms**, among which the nematocyst stands out as a specialized cell **found in creatures like jellyfish, corals, sea anemones, and hydras**.
- These cells act as potent weapons for hunting prey and defending against predators.
- Each nematocyst **consists of a capsule housing a coiled, thread-like tubule and a bulbous structure filled with toxins**.
- When triggered, the nematocyst expels the tubule with astonishing speed, exceeding the velocity of a bullet, **making it one of nature's fastest processes in the animal kingdom**.

Role of Nematocyst:

• Crucial Role in Cnidarian Survival Strategies:

Cnidarians like jellyfish rely heavily on nematocysts for feeding and protection.



○ Cnidocytes cells, found in Cnidarians, trigger upon contact with prey, allowing the tubules to pierce the prey's exterior or inject toxins into their bodies, immobilizing or breaking down cells for consumption or defence.

• **Varied Toxins and Their Effects:** Nematocysts contain a variety of toxins with diverse effects.

• **Functioning:** The functioning of nematocysts involves a remarkable process. These cellular weapons rapidly discharge a harpoon-like thread driven by osmotic pressure and elastic energy stored within their structures.

○ This discharge, occurring within milliseconds, involves the ejection of the thread, its elongation, and the subsequent penetration into the target tissue, releasing neurotoxins.

A new antibiotic to target a drug-resistant bacterium

News Excerpt:

Researchers have identified a **new class of antibiotics, Zosurabalpin**, with the potential to **tackle a drug-resistant bacterium, Acinetobacter baumannii**.

About the bacteria 'Acinetobacter baumannii':

- **Acinetobacter baumannii is a Gram-negative bacterium**, meaning it is **protected by inner and outer membranes, making it difficult to treat**.
- Antibiotic-resistant infections pose an urgent threat to human health, particularly those caused by a large group of **Gram-negative bacteria** protected by an **outer shell containing a substance called lipopolysaccharide (LPS)**.
- LPS allows bacteria to live in harsh environments, and it also allows them to evade attack by our immune system.

- Drug discovery that targets harmful **Gram-negative bacteria** is a long-standing challenge owing to difficulties in getting molecules to cross the bacterial membranes to reach targets in the cytoplasm.
- **Gram-positive bacteria** are typically **less harmful and less antibiotic-resistant** than Gram-negative bacteria.

- According to the US Centres for Disease Control and Prevention, it can cause serious **infections in the lungs, urinary tract and blood**.
- It's **resistant to a class of broad-spectrum antibiotics** called **carbapenems**.
- **Carbapenem-resistant Acinetobacter baumannii**, also known as **CRAB**, was at the top of the World Health Organization's list of antibiotic-resistant "priority pathogens" in 2017.
- CRAB is classified as a **priority 1** critical pathogen by the World Health Organization, alongside two other drug-resistant forms of bacteria: **Pseudomonas aeruginosa and Enterobacteriaceae**.
- CRAB accounts for about 2% of infections found in US hospitals.
 - It's more common in Asia and the Middle East and causes up to 20% of infections in intensive care units worldwide.

National Essential Diagnostics List

News Excerpt:

The Indian Council of Medical Research (ICMR) has begun **revising** the current National Essential Diagnostics List (NEDL).

About National Essential Diagnostics List (NEDL)

- **Essential diagnostic tests** are defined as those "that satisfy the priority healthcare needs of the population and are selected with due regard to disease prevalence and public health relevance, evidence of efficacy and accuracy, and comparative cost-effectiveness".
- In 2018, the World Health Organisation recommended developing and implementing a NEDL to facilitate the availability of in-vitro diagnostics across the various tiers of the healthcare pyramid in facilities with or without an onsite laboratory.
 - **ICMR then released India's first NEDL in 2019** to make the availability of diagnostics an essential component of the healthcare system.
- The NEDL lists the essential and most basic tests that should be available at various levels of healthcare facilities in the country, **including at the village level, in sub-health centres, health and wellness centres, and primary health centres**.

National Essential Diagnostics List (NEDL) 2019

- It aimed to bridge the gap of the then regulatory system, which **did not cover all medical devices and in-vitro diagnostic devices (IVD)**.
- With this list, **India became the first country** to compile a list that would guide the government in deciding the kind of diagnostic tests required by different healthcare facilities in villages and remote areas.

The Indian Council of Medical Research (ICMR)

- Sir Harcourt Butler established the India Research Fund Association (IRFA) on November 15, 1911.
 - In 1949, the IRFA was renamed the Indian Council of Medical Research.
- The Government of India funds the ICMR through the Department of Health Research, Ministry of Health & Family Welfare.
- Its vision is translating research into action to improve the population's health.
- The Indian Council of Medical Research (ICMR), New Delhi, the apex body in India for the formulation, coordination and promotion of biomedical research, is one of the oldest medical research bodies in the world.

Aminocyanine Molecules

News Excerpt:

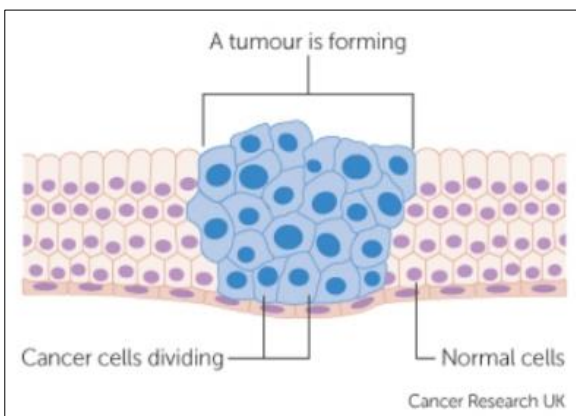
Scientists have identified a novel method to eliminate cancer cells using **aminocyanine molecules**.

About Aminocyanine molecules:

- These molecules can **break apart cancer cell membranes when stimulated by near-infrared light**.
- It is commonly used as a **synthetic dye in bioimaging**.
- It demonstrates over a million times faster mechanical motion than its predecessors.
- **Near-infrared light** holds significant importance, **facilitating deeper penetration into the body**.
- This breakthrough could potentially revolutionize the **treatment of cancers in bones and organs, eliminating the need for invasive surgeries**.

Difference between Cancer cells and Normal cells:

- **Cancer cells don't stop growing and dividing:**
 - Normal cells follow a typical cycle: They grow, divide and die. Cancer cells, instead of dying, they multiply out of control and continue to reproduce other abnormal cells.



- **Cancer cells ignore signals from other cells:**

- Cells send chemical signals to each other all the time. Normal cells obey signals. But something in cancer cells stops the normal signalling system from working.
- **Cancer cells don't stick together:**
 - Cancer cells can lose the molecules on their surface that keep normal cells in the right place. So, they can break away from their neighbours.
- **Cancer cells don't specialize:**
 - Unlike healthy cells, cancer cells don't carry on maturing or become so specialized.
 - Cells mature to carry out their function in the body. This maturing process is called **differentiation**.
- **Cancer cells don't repair themselves or die:**
 - Normal cells can repair themselves if their genes become damaged. This is known as DNA repair.
 - The molecules that decide whether a cell should repair itself are faulty in cancer cells.
 - **For example**, a protein called p53 usually checks if the cell can repair its genes or if it should die.
 - However, many cancers have a faulty version of p53, so they don't repair themselves properly.
- **Cancer cells look different:**
 - Cancer cells are different sizes, and some may be larger than normal while others are smaller, have an abnormal shape, and have a nucleus (control centre) that looks abnormal.

Green Menstrual Hygiene

News Excerpt:

A team at Stanford University has found the absorption capacity of a **sisal-based material** to be higher than that of commercial menstrual pads.

About Sisal Leaves:

- **Sisal has an uncanny ability to store water** and thrive in drought-prone areas. Its leaves grow up to **2 m long**.
- The lifespan of a sisal plant is about **7-10 years**, during which it produces 200-250 usable leaves.
- **Each leaf has about a thousand fibres that can be used to make ropes, paper, and cloth. Now, it could also be used to make a highly absorbent material.**
- The plants grow best in moderately **rich soil** with good drainage and **in warm, moist climates**.
- Sisal is mainly found in **Orissa, Maharashtra, and the southern states of India**.

About Sanitary Napkins from Sisal Leaves:

- To make menstrual hygiene products more environmentally sustainable, scientists at Stanford University have reported a method to produce from sisal leaves a **"highly absorbent and retentive material"**.

- As a result, the researchers posit in their Nature Communications Engineering paper that the material can potentially replace cotton, wood pulp, and chemical absorbents in sanitary napkins.
- The **absorption capacity of the material is higher than those found in commercial menstrual pads.**
 - The absorbent material in sanitary napkins is often a combination of wood pulp and synthetic superabsorbent polymers (SAPs).

Indigenously developed Hepatitis A vaccine

News Excerpt:

Vaccine maker **Indian Immunologicals Ltd (IIL)** launched the **country's first indigenously developed Hepatitis A vaccine.**

About the Vaccine:

- The vaccine 'Havisure' represents a significant step forward in India's fight against Hepatitis A and is poised to substantially contribute to public health.
- Havisure will be manufactured at IIL's **Gachibowli plant in Hyderabad.**
- It is a **two-dose vaccine**; the first dose is administered at above 12 months of age and the second at least **six months after the first dose.**
- According to IIL, the vaccine is **recommended for children as part of routine immunization** as well as for individuals at risk of exposure or travel to regions with high hepatitis A prevalence.

About Indian Immunologicals Ltd (IIL):

- Indian Immunologicals (IIL) was **established by the National Dairy Development Board (NDDB) in 1982** as its unit **to make vaccines available to farmers at an affordable price.**

Hepatitis A



Hepatitis A is an inflammation of the liver that can cause mild to severe illness.

The hepatitis A virus (HAV) is transmitted through ingestion of contaminated food and water or through direct contact with an infectious person.

Almost everyone recovers fully from hepatitis A with a lifelong immunity. However, a very small proportion of people infected with hepatitis A could die from fulminant hepatitis.

The risk of hepatitis A infection is associated with a lack of safe water and poor sanitation and hygiene (such as contaminated and dirty hands).

A safe and effective vaccine is available to prevent hepatitis A.

- The unit was corporatized as Indian Immunologicals Limited in the year 1999.
- IIL started manufacturing **human vaccines in 1998** at a specific request by the Government of India.
- IIL is the second company in the world and the first in India to launch **purified vero cell rabies vaccine (PVRV) and market it under the Abhayrab brand.**

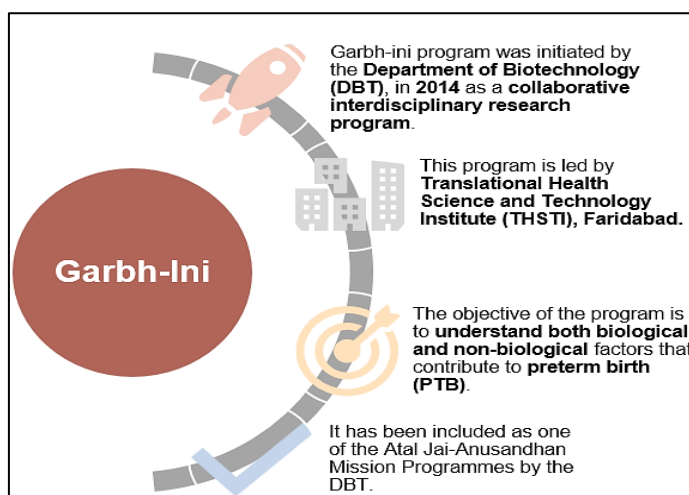
Garbhini-GA2: India-specific AI model to determine age of foetus.

News Excerpt:

Researchers at the **IIT Madras and Translational Health Science and Technology Institute, Faridabad** have developed the **first India-specific artificial intelligence (AI) model** to precisely determine the age of a foetus in the second and third trimesters of pregnancy.

More about Garbhini-GA2:

- The **Garbhini-GA2 is the first late-trimester gestational age estimation model to be developed and validated using Indian population data.**
 - Currently, the age of a foetus (gestational age, GA) is determined using a formula developed for Western populations and are likely to be erroneous when applied in the later part of pregnancy due to variations in the growth of the foetus in the Indian population.
- Garbhini-GA2 accurately **estimates the foetus' age**, reducing error by almost three times.
- The research is a part of an **interdisciplinary group for advanced research on birth outcomes** — the DBT India initiative (**GARBH-Ini**) programme.



Application and Importance of the model:

- **Ultrasound dating** is the standard practice in early pregnancy to **determine gestational age (GA).**
 - However, a significant portion of women in India undergo their first ultrasound during the second or third trimester.

- Utilizing Indian population-specific GA formulas in these cases can potentially enhance pregnancy care by providing more accurate estimates.
- Improved accuracy in dating pregnancies can lead to **better outcomes for both mothers and infants.**
- This deployment of Garbhini-GA2 will enhance the quality of care provided by **obstetricians and neonatologists**, ultimately contributing to the **reduction of maternal and infant mortality rates in India.**

Rhodamine B, the cancer-causing chemical

News Excerpt:

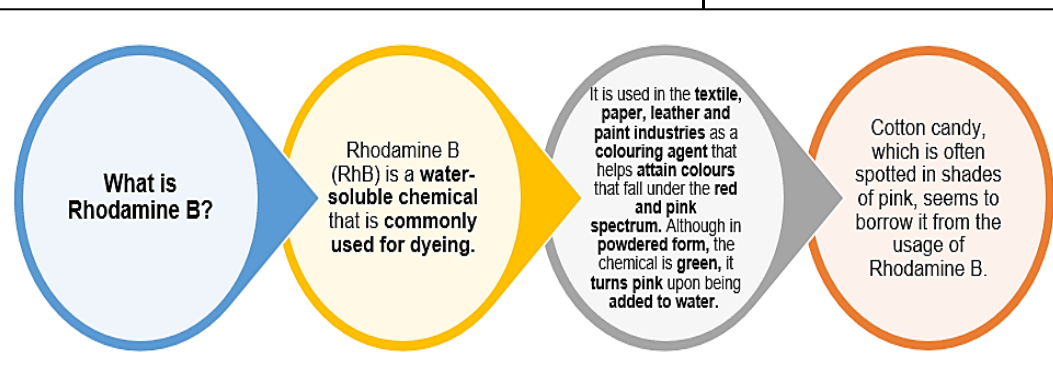
The **Tamil Nadu government banned the sale and production of cotton candy** in the state after it was found that the **toxic chemical Rhodamine-B** was being used to make it.

About the news:

- Earlier, **Puducherry banned the sale** of cotton candy after it was declared **'unsafe'** for consumption because it contained Rhodamine-B.
- Rhodamine-B (RhB) is **highly toxic** for humans and is **banned** under the **Food Safety and Standards Act 2006.**

Why is it harmful?

- If food containing this chemical is consumed regularly, it can cause **damage to the cerebellum tissue** in the brain and **to the brainstem** that connects the brain to the spinal cord.
- Even if consumed in **low quantities**, the chemical is **highly toxic** and **carcinogenic.**
- **RhB**, as a **colouring agent** in food products, is **prohibited** as per the **Food Safety and Standards Act 2006.**



Serum's HPV vaccine is non-inferior to Gardasil

News Excerpt:

Serum Institute's **Cervavac, a quadrivalent HPV vaccine**, was found safe and comparable to Gardasil in a phase-2/3 trial in India.

About the news:

- The trial found that two doses of the Serum's Cervavac vaccine generated nearly double the antibody response

against **HPV subtypes compared** with the response generated with Gardasil vaccine.

- The study focused on adolescents, as the effectiveness of the HPV vaccine tends to be higher when administered at a younger age.
- Serum's vaccine was evaluated based on WHO's recommendations, using an **immunobridging approach**, comparing immune responses with the efficacy-proven population of women aged 15-26 who received Gardasil.

Immunobridging approach

- Immunobridging approach is a method used to evaluate the efficacy of a new vaccine by comparing the immune response of the new vaccine to that of an already established vaccine.
- This approach is based on the World Health Organization's recommendations for the evaluation of HPV vaccines.
- The immune responses observed with the new vaccine are compared with those obtained in an efficacy-proven population.

What is immunobridging?

Immunobridging is an approach to clinical trial design that aids in predicting the protection offered by a new therapy.

The principle is to show that a new therapy neutralises a currently circulating virus as well as an older therapy neutralises an earlier version.

Operation AMRITH

News Excerpt:

The Kerala government launches Operation AMRITH (**Antimicrobial Resistance Intervention for Total Health**) to curb antimicrobial resistance.

About Operation AMRITH:

- With Operation AMRITH, the health department of Kerala is on a drive to **completely stop the over-the-counter sale of antibiotics** without prescriptions by the end of **2024.**
- It **aims** to conduct **surprise raids** in retail and medical shops to detect OTC

sales of antibiotics.

- The **public** can also participate in this initiative by **reporting** any pharmacies selling antibiotics without a prescription to the **Drug Control Department.**
- The Kerala government was the **first state** in India to come up with a **state action plan** on Antimicrobial Resistance, named **Kerala Anti-Microbial Resistance Strategic Action Plan (KARSAP)**, in 2018.



No prescription, no antibiotics

Kerala's Operation AMRITH prohibits over-the-counter (OTC) sales of antibiotics without a prescription

- Kerala has implemented the 2011 H1 rule that prohibits OTC sales of all classes of antibiotics
- Kerala's high doctor-patient ratio even in villages may help in enforcing the H1 rule
- Over 50-70% of antibiotic prescriptions by doctors are deemed unnecessary and irrational
- Reducing the incidence of hospital-acquired infections will sharply and quickly reduce the demand for antibiotics
- All hospitals should be made to report rates of hospital-acquired infections to the State government
- Rationalising antibiotic use in hospitals, and banning growth-promotional use of antibiotics in poultry and fish farms, and agriculture will have a big impact
- Curbing antimicrobial resistance requires a multipronged approach. Enforcing the OTC regulation alone will not be sufficient

- Everybody has some sugar attached to their haemoglobin. Those with pre-diabetes and diabetes, however, have more.
- While the traditional blood sugar tests may fluctuate depending on items in the person's latest meal and when they last consumed it, **the HbA1C test is independent of these variables, making it more reliable.**

What are the test's limitations?

- The HbA1C test does **not replace other tests** and **may be carried out alongside the traditional blood sugar tests** to test for diabetes and pre-diabetes.
- It is **not uniformly accepted as a diagnostic test by all global medical bodies** because of its relatively low sensitivity arising from **difficulties in assay standardisation.**
- In some clinical situations, **accurate measurements are harder to make by this test** like:
 - Thalassaemia,
 - Structural haemoglobin variants in the population,
 - Iron deficiency anaemia (relatively high in India), and
 - The use of certain drugs.

HbA1C test for diabetes

News Excerpt:

According to 2018 ICMR guidelines, everyone older than 30 years should be screened for diabetes.

Current status of diabetes in India:

- India is estimated to have **10.13 crore people with diabetes, and another 13.6 pre-diabetic crore people**, according to a nationwide study published in 2023.
- This apart, over **35% of Indians suffer from hypertension and nearly 40% from abdominal obesity**, both of which are risk factors for diabetes.
- **India accounts for 17% of all diabetes patients in the world.**

What Is Diabetes?

- Diabetes is a disease that occurs when your blood glucose, also called **blood sugar, is too high.**
 - Glucose is the body's main source of energy. The body itself makes glucose and it also comes from the food you eat.
- **Insulin is a hormone made by the pancreas that helps glucose get into your cells to be used for energy.**
 - If one has diabetes, the body doesn't make enough or any insulin, or doesn't use insulin properly. **Glucose then stays in your blood and doesn't reach your cells.**

About the HbA1C test for Diabetes:

- One of the most commonly-used tests to diagnose pre-diabetes and diabetes (both type 1 and type 2) and to help manage diabetes, is the **haemoglobin A1C (HbA1C) test.**
 - It is also known as the **glycated haemoglobin or glycosylated haemoglobin test.**
- The HbA1C test measures the percentage of red blood cells that have **sugar-coated, or glycated, haemoglobin.**

Indigenous drug for sickle cell disease

News Excerpt:

Recently, the Delhi-based Akmus Drugs and Pharmaceutical Limited announced the development of a new drug for sickle cell disease.

About the newly developed drug:

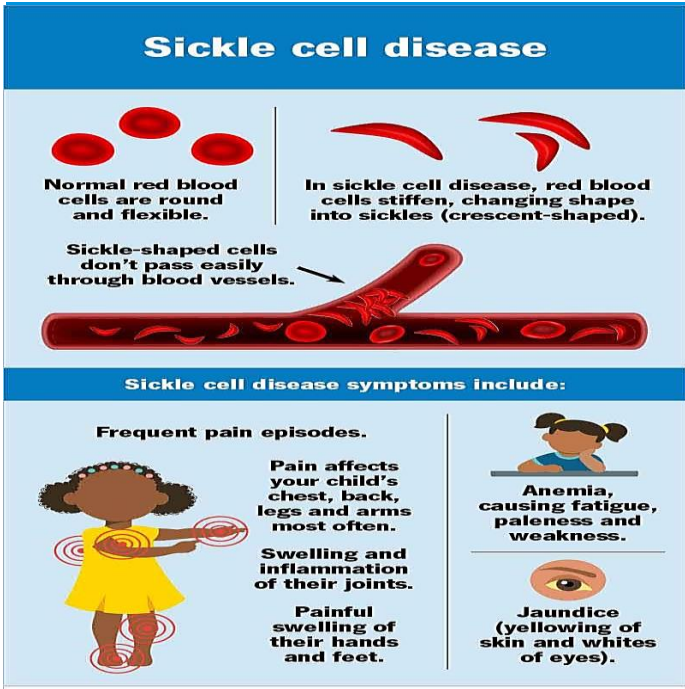
- The development of the room temperature stable, oral suspension of Hydroxyurea is tailored **specifically for patients battling sickle cell disease, spanning across all age groups.**
- **Oral syringes** would be provided **for precise dosage administration.**
- The drug would be the **country's first indigenous, room-temperature stable drug** for sickle cell disease to be **available at only 1% of the global price.**
 - The pharma company is expected to provide the government the medicine for less than ₹600.

Sickle cell anaemia in India:

- According to the Indian Journal of Medical Research, India is home to over **20 million patients with sickle cell disease.**
- **It is more common in the tribal population of India** but occurs in non-tribals too.

About National Sickle Cell Anaemia Elimination Mission:

- The National Sickle Cell Anaemia Elimination Program, introduced in the **Union Budget 2023**, focuses on



addressing the significant health challenges posed by sickle cell disease, particularly among tribal populations of the country.

- Implemented in **17 high-focus states** across the country, this program aims to improve the care and prospects of all sickle cell disease patients while reducing the prevalence of the disease.
 - The 17 states are-** Gujarat, Maharashtra, Rajasthan, Madhya Pradesh, Jharkhand, Chhattisgarh, West Bengal, Odisha, Tamil Nadu, Telangana, Andhra Pradesh, Karnataka, Assam, Uttar Pradesh, Kerala, Bihar, and Uttarakhand.
- The program is executed in a mission mode **as part of the National Health Mission (NHM)**.
- It aims to eliminate sickle cell genetic transmission by the year 2047**, showing a long-term commitment to eradicating the disease.
- Over a period of three years, spanning from the fiscal year 2023-24 to 2025-26, the program targets screening approximately 7.0 crore people.

Antibacterial compound that can kill Mycobacterium Abscessus

News Excerpt:

Scientists have isolated an antibacterial compound that can kill **Mycobacterium abscessus**, a relative of the bacteria that cause **tuberculosis**, without generating any signs of bacterial drug resistance in infected mice.

Key highlights of the study:

- The safety profile and efficacy suggest that it can be used for **treating people infected with M. abscessus**, which is very hardy and frequently shrugs off standard antibiotic protocols.
- M. abscessus is growing more common worldwide and can **cause severe lung infections**.

About Mycobacterium abscessus:

- Mycobacterium abscessus (also called M. abscessus) is a **bacterium distantly related to the ones that cause tuberculosis and Hansen’s Disease (Leprosy)**.
- It is part of a group of environmental mycobacteria and is **found in water, soil, and dust**.
- It has been **known to contaminate medications and products**, including medical devices.
- Healthcare-associated infections due to this bacterium usually **occur in the skin and the soft tissues under the skin**.
 - Skin infected with M. abscessus is usually red, warm, tender to the touch, swollen, and/or painful.
- It is also a cause of **serious lung infections in persons with various chronic lung diseases**, such as **cystic fibrosis**.

Real-time human emotion recognition technology

News Excerpt:

Scientists have made a **skin-integrated face interface technology (PSiFI)** to **recognize human emotions in real-time**.

About the PSiFI system:

- This technology **utilizes machine learning algorithms** to identify human emotions precisely in real-time.
 - Machine learning empowers the technology to **recognize emotions, even when individuals wear masks**.
- The system includes a **data processing circuit for wireless data transport**, which enables real-time emotion identification.
 - The sensor can simultaneously capture verbal and non-verbal cues.
- This is **wearable mask-like technology**.
 - Scientists **created a customized mask by photographing from many angles**.
 - This process includes taking photos from multiple angles, **resulting in a mask that combines flexibility, elasticity, and transparency** to provide a tailored and comfortable fit.
- The study team successfully **integrated face muscle deformation and voice cord vibration detection into the system**.
- Scientists **used a “semi-curing technique”** to create a transparent conductor for the electrodes that charged friction.
 - This procedure includes partly curing or setting the material, resulting in a conductor that enables efficient friction charging.

World's most powerful MRI machine unveiled

News Excerpt:

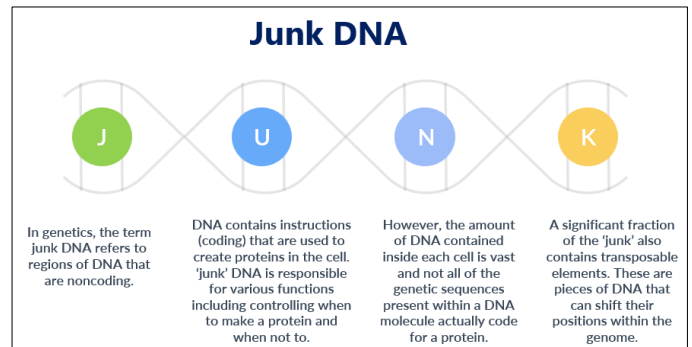
The world's **most powerful MRI scanner** has produced its initial images of human brains, achieving an unprecedented level of precision expected to illuminate more about our enigmatic minds and the ailments that afflict them.

More About the News:

- The machine was developed by **France's Atomic Energy Commission (CEA)** situated in the **Plateau de Saclay region south of Paris**, known for its concentration of technology firms and academic institutions.
- The scanner generates a **magnetic field of 11.7 teslas**, a measurement unit named after inventor **Nikola Tesla**.
- This capability enables the machine to capture images with tenfold greater precision compared to the commonly used hospital MRIs, typically with a power of up to 3 teslas.
- **Objective:** To enhance our comprehension of brain anatomy and the specific brain regions activated during various tasks. Utilizing MRIs, scientists have already demonstrated that the brain's cerebral cortex exhibits distinct patterns of activation when recognizing specific stimuli such as faces, locations, or words.

sequence that seemingly serves no biological purpose.

- They identified the snippet, known as **Alu element**, in the regulatory code of a gene associated with tail length called **TBXT**.



About TBXT (T-box transcription factor T) gene:

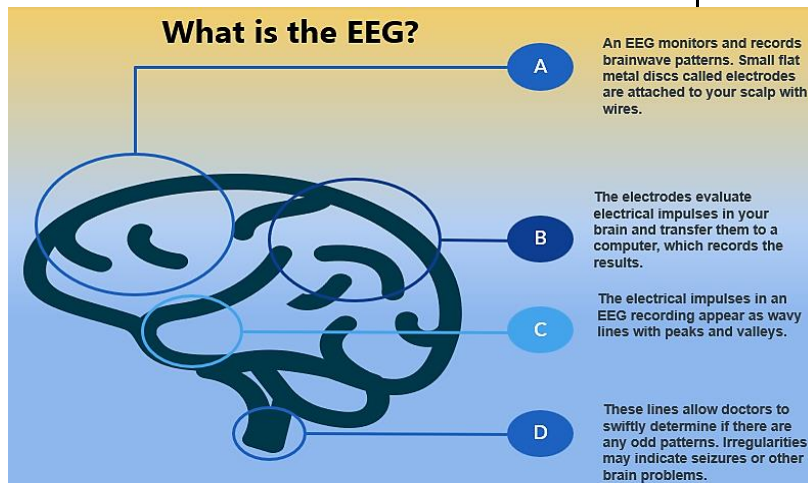
- The **TBXT gene** provides **instructions for making a protein called brachyury**.
- **Brachyury** is a member of a protein family called **T-box proteins**, which play critical roles **during embryonic development**.
- **T-box proteins regulate the activity of other genes by attaching (binding) to specific regions of DNA**.
- On the basis of this action, T-box proteins are called **transcription factors**.

Compact Genome:

- Scientists in the mid-1990s observed that simple organisms like **bacteria** maintain **highly compact genomes**.
- Bacterial genomes exhibit a **tandem arrangement of genes**, where **one gene ends, another begins**.

Alu Element:

- One such **transposable element**, called **Alu**, is unique to **primates (both apes and monkeys)**.
- It is **tiny**, being made up of **around 300 base-pairs** (the **human genome** is approximately **3 billion base-pairs**), but has the ability to **copy** itself and **'jump'** within the genome.



Junk DNA led to humans being tailless

News Excerpt:

According to new research, a genetic change in our ancient ancestors may partly explain why humans don't have tails like monkeys.

More about the research:

- Scientists have traced our tail loss to a short sequence of genetic code that is abundant in our genome but had been dismissed for decades as junk DNA, a

Project ANAGRANINF

News Excerpt:

The **Technology Development Board (TDB)** has signed an agreement with **Peptris Technologies** and the **Foundation for Neglected Disease Research (FNDR)**, for the development of the project **"ANAGRANINF"** - (a **novel class of Antibiotics Against Gram-Negative Bacterial-Infections**).

About Project ANAGRANINF:

- The Project is a collaborative endeavour to foster innovation in the field of healthcare.

- It is a joint effort between **Indian and Spanish companies**, led by the **Department of Science & Technology** and the **Centre for the Development of Technology and Innovation, E.P.E. (CDTI)**.
- The bilateral programme aims to drive **market-driven research and technology development** while fostering partnerships and **business-led collaborative projects** between the two nations.

Gram-negative bacteria:

- These are a type of bacteria characterized by the **structure of their cell walls**.
- These bacteria have a **thin peptidoglycan** layer sandwiched between two membranes, with an **outer membrane containing lipopolysaccharides**.
 - This double-membrane structure makes them **more resistant to certain antibiotics** and contributes to their pathogenicity.
 - They are **harder to kill** because of their **harder cell wall**.
 - When their cell wall is disturbed, gram-negative bacteria **release endotoxins** that can make the symptoms worse.
- They are found in various environments, **including soil, water, and within the bodies of humans and animals**.

E.g.- **Escherichia coli (E. coli), Salmonella spp., Pseudomonas aeruginosa, and Neisseria gonorrhoeae.**

Objectives of Project ANAGRANINF:

- Create a **novel lead compound**, particularly an **antibiotic** which is capable of **inhibiting the FabI enzyme** and effectively **fighting against gram-negative pathogens**.
- Produce a series of compounds that exhibit enhanced efficacy for tackling Antimicrobial Resistance (AMR) infections.
- The selected hit **molecule MMV1578564** has exhibited promising activity against gram-negative pathogens, serving as a foundation for further research and development efforts.
- Identify a candidate that meets WHO's **innovation criteria**, ensuring a **new chemical structure, no cross-resistance** with existing commercial classes, a novel target, and a novel mechanism of action.

WHO launches 'CoViNet'

News Excerpt:

The World Health Organization (WHO) has established a new network called **CoViNet**, aimed at enhancing global capacities for the detection, monitoring, and assessment of coronaviruses.

About the news:

CoViNet expands upon the **groundwork laid by the WHO COVID-19** reference laboratory network established in January 2020, broadening its **focus beyond SARS-CoV-2**

to include other coronaviruses such as **MERS-CoV** and potential novel coronaviruses of public health importance.

What is CoViNET?

- The CoViNet initiative underscores a **comprehensive One Health approach**, which integrates expertise from various sectors including human, animal, and environmental health.
- **By pooling resources and expertise**, CoViNet seeks to effectively monitor and assess the evolution and spread of coronaviruses.
- **Why it came into the picture?**
 - The WHO SARS-CoV-2 **Reference Laboratory Network**, established in 2020, initially aimed to provide confirmatory testing to countries with limited testing capacity for **SARS-CoV-2**.
 - However, as the pandemic progressed, the **need to monitor the virus's evolution**, the spread of variants, and their impact on public health became increasingly apparent.

CoViNet's core objectives include:

- Early and accurate detection of SARS-CoV-2, MERS-CoV, and other novel coronaviruses of public health importance.
- **Surveillance and monitoring of the global circulation and evolution** of these coronaviruses, adopting a One Health approach that includes expertise in animal health and environmental surveillance.
- **Timely risk assessment** to inform WHO policies related to public health and medical countermeasures.
- **Support for capacity building of laboratories.**

S.A.R.A.H

News Excerpt:

The World Health Organization (WHO) has announced the launch of **S.A.R.A.H.**, a digital health promoter prototype.

More about S.A.R.A.H

- **S.A.R.A.H.** is a **Smart AI Resource Assistant for Health** that represents an evolution of AI-powered health information avatars, using new language models and cutting-edge technology.
 - It can engage users **24 hours a day in 8 languages** on multiple health topics, on any device.
- **It is trained to provide information on major health topics**, including **healthy habits and mental health**, to help people optimize their health and well-being journey.
- **S.A.R.A.H.** can support people in **understanding risk factors** for leading causes of death like **cancer, heart disease, lung disease, and diabetes**.

- It can provide **up-to-date information** on **quitting tobacco**, being active, eating a healthy diet, and **de-stressing**, among other things.
- **S.A.R.A.H.** is powered by generative AI, it can provide more **accurate real-time responses**, engage in dynamic personalized conversations.
 - It provides **nuanced, empathetic responses in a judgment-free environment**.
- **S.A.R.A.H.** is a continuous learning and development project, aiming to inspire **reliable, responsible, and accessible information**.

Introducing "nitroplast" - The first nitrogen-fixing organelle.

News Excerpt:

An international team of researchers has discovered the "nitroplast" — the first known **nitrogen-fixing organelle within a eukaryotic cell**.

More About News:

The **nitroplast organelle** discovery marks the **fourth instance of primary endosymbiosis** in history, a process where a **prokaryotic cell** is engulfed by a **eukaryotic cell** and evolves into an **organelle**.

Implications for ocean ecosystems and agriculture:

- The discovery of the **nitroplast** provides new **insights into ocean ecosystems**.
 - UCYN-A is **globally important for its ability to fix nitrogen** from the atmosphere, and researchers have found **it in various locations, from the tropics to the Arctic Ocean**, where it fixes a significant amount of nitrogen.
- The nitroplast also has **the potential to revolutionize agriculture**.
- The **Haber-Bosch process**, which synthesizes **ammonia fertilizers from atmospheric nitrogen**, allowed **agriculture and the world population to take off** in the early 20th century.
- However, it also creates **enormous amounts of carbon dioxide**, accounting for about **1.4% of global emissions**.

Rollout of Men5CV vaccine in Nigeria

News Excerpt:

Nigeria has become the **first country in the world** to roll out a new vaccine (called **Men5CV**) recommended by the **World Health Organization (WHO)**, which protects people against **five strains of the meningococcus bacteria**.

About the news:

- The new vaccine offers a powerful shield against the **five major strains of the meningococcal bacteria (A, C, W, Y, and X) in a single shot**. This provides broader protection than the current vaccine used in much of Africa, which is only effective against the A strain.

- The vaccine and emergency vaccination activities are funded by **Gavi, the Vaccine Alliance**, which funds the global meningitis vaccine stockpile and supports lower-income countries with routine vaccination against meningitis.
- Nigeria is one of the 26 meningitis **hyper-endemic countries of Africa**, situated in the area known as the **African Meningitis Belt**.
- Nigeria's rollout moves the world one step closer to **WHO's goal of defeating meningitis by 2030**.

About Meningitis:

- Meningitis is a **serious infection** that leads to the **inflammation** of the membranes (meninges) that surround and protect the **brain and spinal cord**.
- There are multiple causes of meningitis, including **viral, bacterial, fungal, and parasitic pathogens**.
- **Bacterial meningitis** is the **most serious** among the five.
- **Symptoms-** fever, headache, stiff neck, sensitivity to light (photophobia), nausea, vomiting, confusion, altered mental state, etc.
- Although meningitis affects all ages, **young children are most at risk** with around half of cases and deaths occurring in **children under 5 years of age**.

Whooping cough outbreak

News Excerpt:

Whooping cough outbreak has left **health authorities** across different countries worried. Apart from **several deaths** reported in **China**, cases have also been reported in the **US, UK, Philippines, Czech Republic and the Netherlands**.

What is whooping cough?

- **It is also called pertussis**.
- It is a highly **contagious bacterial infection**, caused by **bacteria Bordetella pertussis**, and is common in **infants and young children**.
- It usually causes lengthy and repeated **bouts of coughing**.
- These coughing episodes can continue for **weeks or even months** after first developing symptoms of the illness.
- The infection transmits easily from **person to person** mainly through **respiratory droplets** produced by the **infected person while coughing or sneezing**.

How's it diagnosed?

- Diagnosis is usually based on coughing fits in presence of known exposure to disease.
 - Laboratory tests, such as **polymerase chain reaction (PCR)** or **culture of respiratory secretions**,
- It can confirm the diagnosis by detecting the presence of **Bordetella pertussis bacteria**.

Prevention:

- **Vaccination** is the most **effective measure** to **prevent this infection**.
 - **DTaP (Diphtheria, Tetanus, and acellular Pertussis)** vaccine is recommended for **children**.
 - **Tdap (Tetanus, Diphtheria, and acellular Pertussis)** vaccines can be given to **adults that provide protection against pertussis**.

Global Prostate Cancer Crisis

News Excerpt:

A report on prostate cancer by **the Lancet Commission** has unveiled a looming global crisis in the fight against the disease.

Prostate Cancer

- Prostate Cancer and most other cancers can be called a **lifestyle disease**.
- It is common for elderly men to have **Lower Urinary Tract Symptoms (LUTS)** which includes **urgency, frequency of micturition, difficulty in passing urine and incomplete bladder evacuation**.
- These symptoms require testing for enlarged prostate which mostly is non-cancerous (Benign Prostatic Hypertrophy or BPH).

Key findings of the report:

- **Cases of prostate cancer are set to double from 1.4 million annually in 2020 to a staggering 2.9 million per year by 2040.**
- It will be the low- and middle-income countries (LMICs) that will see the surge in these cases.
- Prostate cancer is a significant contributor to **mortality and disability, accounting for 15% of all male cancers globally.**

Causes of Prostate Cancer:

- **Genetic Factors:** Family History, Genetic Mutations, Race and Ethnicity, Age and Hormonal Factors, Hormonal Imbalances are the major factors.
- **Environmental Factors:** Diets high in red meat and high-fat dairy products and low in fruits and vegetables and Sedentary lifestyles and obesity are the other factors.
- **Medical Factors:** **Chronic inflammation of the prostate**, often seen in conditions like prostatitis. Sexually Transmitted Infections are also the important factors.

10,000 genomes of Indian population sequenced as part of Genome India Project

News Excerpt:

The Government's ambitious **Genome India initiative** achieved a significant milestone as researchers completed sequencing 10,000 healthy genomes from

different regions of the country, representing 99 distinct populations.

Genome India Project:

- **The Department of Biotechnology (DBT)** initiated the "**Genome India Project**" (GIP) in 2020.
- The GIP's aim was to collect **10,000 genetic samples** from citizens across India, to build a **reference genome**.
- The project is led by the **Centre for Brain Research** at the **Indian Institute of Science (IISc)**, which acts as the central coordinator between a collaboration of 20 leading institutions.
- The Department of Biotechnology (**DBT**) has officially announced the completion of the '**10,000 genome**' sequencing.

Significance of Genome Sequencing:

- India first sequenced a complete human genome in **2006**.
- The **United Kingdom, China, and the United States** are among the countries that have programmes to **sequence at least 1,00,000 of their genomes**.

AIIMS AI tool for cancer therapy

News Excerpt:

A **supercomputer** and **AI (iOncology AI)**, developed by researchers from the **All-India Institute of Medical Sciences (AIIMS) Delhi** promises to **identify the best cancer therapy** for their patients.

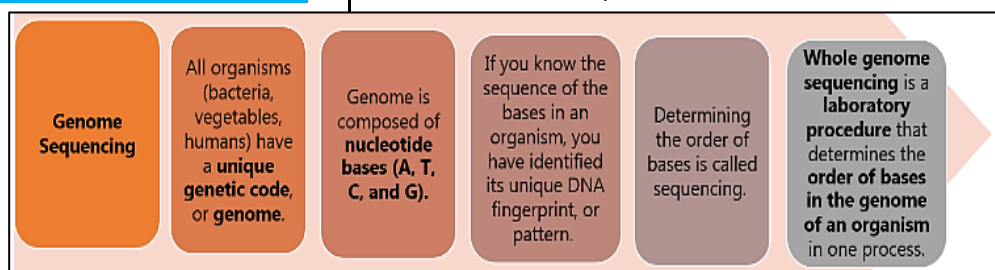
- With iOncology AI, which employs a supercomputer in Pune and a high-capacity server called **Charak I at the National Cancer Institute campus in Jhajjar**, doctors are attempting to determine the most common type of genetic mutation in their patients, helping them narrow in on the best treatment option.

Objective of iOncology AI:

- iOncology AI aims to **sequence the genomes of 3,000 cancer patients** who are currently seeking treatment at AIIMS.
- It also aims to **address a fundamental question: Does a patient's genetic makeup correlate with the efficacy of diverse cancer therapies?**

Can the tool address all types of cancer?

- The research will **focus on five types of cancers** that are the most common, deadliest, or have immunotherapies available — **breast, ovarian, head,**



and neck, colorectal, and two types of blood cancers.

- At present, the platform is **trained only for breast and ovarian cancer**.
- It already has **various models for CT scan prediction, ultrasound image, histopath prediction, mammogram image prediction and detection and classification of the tumour**.

- The drug dosage adjustment and efficacy are under investigation through animal models.
- Clinical trials will follow this.

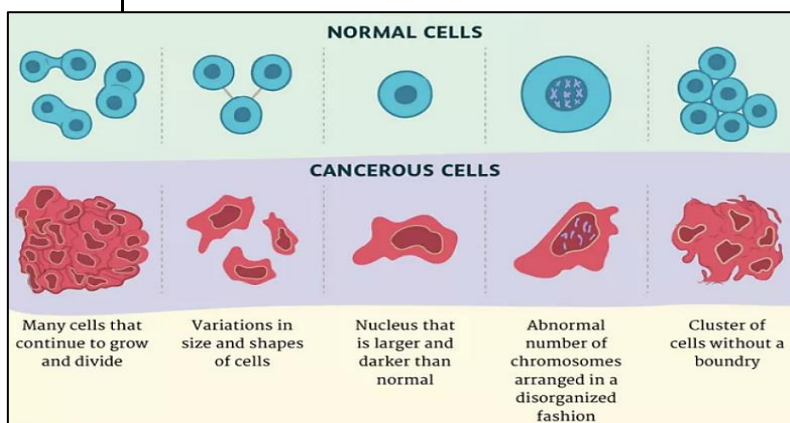
Indian Spices used in Nanomedicines to treat cancer

News Excerpt:

Recently, researchers at the Indian Institute of Technology (IIT), Madras, have **patented** the use of **Indian spices** to develop **Nanomedicines** to treat cancer.

About the Nanomedicines:

- The application of nanotechnology for medical purposes has been termed nanomedicine and is defined as the use of nanomaterials for diagnosis, monitoring, control, prevention and treatment of diseases.
 - **It uses the properties developed by a material at its nanometric scale of 10⁻⁹ m.**
- The patented Indian spice-based nano-formulations have **proven effective** in **common types of cancers** through in-vitro studies.
 - **The nanomedicines** have shown **anti-cancer activity** against lung, breast, colon, cervical, oral and thyroid cell lines.
 - They were found to be safe in normal cells.
- **Animal studies** have been carried out on the patented anti-cancer nano-formulations.
 - Animal validation to adjust the dosage (**GLP phase**) and efficacy studies (**non-GLP phase**) have been carried out successfully.

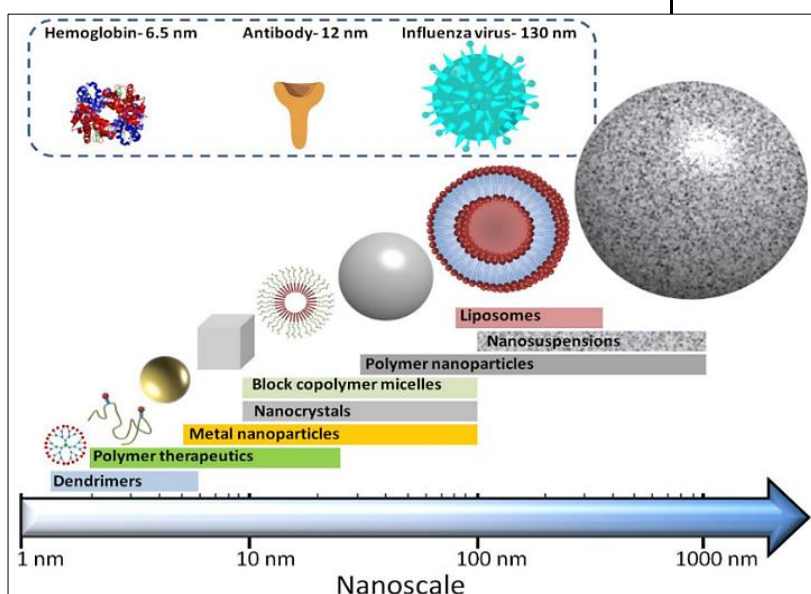


Significance of the newly patented Nanomedicine:

- India is the world's largest spice producer. Hence, **large-scale production could be achieved at a low cost**.
- The medical benefits of Indian spice oils have been known through the ages, but their **bioavailability** has limited their application and use.
- Formulation as a **nano-emulsion effectively overcomes this limitation**.
- **The stability of the nano-emulsion** was a key consideration in the process of making medicine effective.
- The spices chosen are edible. Hence, **biocompatibility** is good, **reducing toxic side effects**.
- This cancer nanomedicine is being developed to **reduce the cost and pain** of cancer treatment.
- The formulations are developed for an **oral route of administration** to ease the treatment process.
- Cancer nanomedicine is considered superior to conventional treatment strategies owing to its **reduced toxicity, improved drug accumulation, suitable size spectrum** in the nanometre range and **increased circulation time**.

About T cells:

- T-cells are a **type of white blood cell called lymphocytes**.
- They **help our immune system fight germs** and protect us from disease.
- There are **two main types** -
 - **Cytotoxic T-cells:**
 - Cytotoxic T-cells are **also called CD8+ cells** because they have a **CD8 receptor on their membranes**.
 - These cells get their name from "cyto," which means cell, and "toxic," which means poisonous or harmful.



- Cytotoxic T-cells **kill cells infected with viruses and bacteria and destroy tumour cells.**
- **Helper T-cells:**
 - Helper T-cells are **called CD4+ cells** because they have a **CD4 receptor on their membranes.**
 - Unlike cytotoxic T-cells, helper T-cells **don't kill cells directly.**
 - Instead, they **send signals that tell other cells in our immune system how to coordinate an attack against invaders.**
 - Helper T-cells **signal cytotoxic T-cells, B-cells, and another type of white blood cell called a macrophage.**
- **Location of T-cells:** T-cells start in our bone marrow, mature in our thymus and eventually relocate to our lymph tissue or bloodstream.
 - **Bone marrow:**
 - T-cells start in the spongy tissue inside our bone called marrow.
 - Like all blood cells, they start as hematopoietic stem cells.
 - These cells have the potential to develop into any type of blood cell.
 - **Thymus:**
 - T-cells move to an organ called our thymus (located in our upper mid-chest) to mature.
 - At this stage, the immature T-cells are called thymocytes.
 - Our thymus is like a boot camp for T-cells.
 - They also receive the right receptor, either CD4 (helper T-cells) or CD8 (cytotoxic T-cells).
 - Only T-cells that pass all these tests go out into our body.
 - **Lymph tissue and bloodstream:**
 - Fully mature T-cells travel to tissue and organs in our lymph system, like our spleen, tonsils and lymph nodes.
 - They may also circulate in our bloodstream.
 - T-cells remain on standby in our body until we need them to protect us.

How does cancer develop?

- Cancer is a genetic disease in which some of the body's cells grow uncontrollably and spread to other body parts.
- Genetic changes that cause cancer can happen because:
 - Of errors that occur as cells divide.
 - Of damage to DNA caused by harmful substances in the environment, such as the chemicals in tobacco smoke and ultraviolet rays from the sun.
 - Of inheriting offspring from their parents.

IT / NANOTECH/ BIOTECH

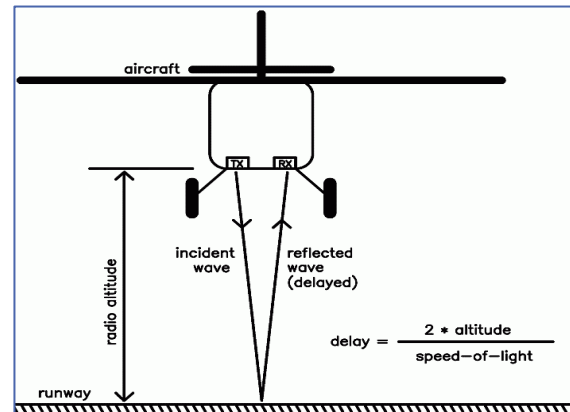
Role of Radio Altimeters Near Airports

News Excerpt:

In the face of 5G expansion, the **Directorate General of Civil Aviation (DGCA)** is ready to make it **mandatory for all airlines to replace radio altimeters (RAs) on their aircraft.**

- This move is designed to facilitate the setting up of 5G base stations near airports.

About Radio Altimeter:



- A radio altimeter is an **airborne electronic device capable of measuring the height of an aircraft above terrain immediately below the aircraft.**
- Early radio altimeters determined altitude by measuring the time between radio signal transmission from the aircraft and reception of the reflected signal.
- **Modern systems use other means, for example, measurement of the change of phase between the transmitted and reflected signal.**
- In low visibility conditions, they bolster pilots' situational awareness, providing vital inputs for onboard systems, such as the **traffic collision avoidance system.**

Developing 140 GHz Fully Integrated Transmitter & Receiver Module for 6G and Beyond

News Excerpt:

C-DOT, the premier Telecom R&D Centre of the Department of Telecommunications (DoT), Government of India and **Indian Institute of Technology, Roorkee (IIT-R)** signed an agreement.

Key takeaways of the agreement:

- The agreement is **signed under the Telecom Technology Development Fund (TTDF)** scheme of the Department of Telecommunications.
- This agreement **aims to develop a 140 GHz Fully Integrated Transmitter and Receiver Module to enable applications for 6G and beyond.**

1G	2G	3G	4G	5G
<p>Released: 1979</p> <p>Standards: NMT, AMPS & TACS</p> <p>Capabilities:</p> <ul style="list-style-type: none"> Analog voice 	<p>Released: 1991</p> <p>Standards: GSM & CDMA</p> <p>Capabilities:</p> <ul style="list-style-type: none"> Digital voice Encrypted communication Limited roaming SMS & MMS <p>Extensions:</p> <ul style="list-style-type: none"> GPRS (2.5G) CDMA2000 (2.5G) EDGE (2.75G) 	<p>Released: 2002</p> <p>Standards: UMTS & EV-DO</p> <p>Capabilities:</p> <ul style="list-style-type: none"> Mobile broadband Locating services Multimedia streaming Seamless global roaming <p>Extensions:</p> <ul style="list-style-type: none"> HSPA+ (3.5G) 	<p>Released: 2009</p> <p>Standards: LTE</p> <p>Capabilities:</p> <ul style="list-style-type: none"> High Speed mobile Internet IP-based packet switching HD multimedia streaming Seamless global roaming <p>Extensions:</p> <ul style="list-style-type: none"> Feature extension through new category/releases 	<p>Released: 2019</p> <p>Standards: 5G</p> <p>Capabilities:</p> <ul style="list-style-type: none"> Private networks (local use frequency) (I)IoT Ready Massive Machine Type communication Ultra-low-latency Ultra-high reliability Millimeter wave support <p>Extensions:</p> <ul style="list-style-type: none"> Feature extension through new categories/releases
<p>0.0024 Mbit/s</p>	<p>0.064 Mbit/s</p>	<p>42 Mbit/s</p>	<p>1,000 Mbit/s</p>	<p>10,000 Mbit/s</p>
<p>Industry Impact: -</p>	<p>Industry Impact: 0</p>	<p>Industry Impact: +</p>	<p>Industry Impact: ++</p>	<p>Industry Impact: +++</p>
<ul style="list-style-type: none"> No impact on industrial applications 	<ul style="list-style-type: none"> Remote control / Telecontrol Text messages from and to remote machines 	<ul style="list-style-type: none"> Video monitoring Remote Access to machines (e.g. for teleservice) Remote Condition Monitoring 	<ul style="list-style-type: none"> Mobile service Technicians Service via smart phones Wireless Backhaul 	<ul style="list-style-type: none"> Autonomous Logistics Autonomous Machines Assisted Work Wireless Backhaul Edge Computing Mobile Equipment

Importance of 'Fully Integrated Transmitter & Receiver Module':

- The novelty of this system lies in the **generation, transmission, and antenna integration of THz waves onto a single chip.**
- It has a key role in indigenously designed & developed 6G technologies in fulfilling the overarching objective of the **'Bharat 6G Mission'**.

About 6G:

- 6G will emerge as the sixth generation of wireless communications, succeeding the 5G wireless technology, which is still untapped in many countries.
- 6G uses tremendously **high frequency (THF) waves**, also known as **sub-millimetre waves**, to achieve speeds 100 times faster than 5G - which, in comparison, uses millimetre waves (mmWave).
- Enabling 6G, the **latency is expected to be less than one microsecond** with increased bandwidth to accommodate enhanced connectivity.

India elected as Co-chair of ITU's Digital Innovation Board

News Excerpt:

India led a high-level delegation to Geneva for a series of crucial meetings at the International Telecommunication Union (ITU) Headquarters.

- The visit **focused on fostering collaboration and exploring innovative initiatives** in the telecommunications and information and communication technology (ICT) sectors.

The key highlights of the visit include:

- The International Telecommunication Union (ITU) has started the **Innovation**

and **Entrepreneurship Alliance for Digital Development** to respond to significant unmet needs of ITU Membership in the area of innovation, as articulated in the **Kigali Action Plan adopted at the World Telecommunication Development Conference 2022 (WTDC-22).**

- The Outcomes of the **ITU Plenipotentiary Conference 2022 (PP-22).** The Alliance has **three main vehicles:**
 - Digital Transformation Lab**
 - Network of Acceleration Centres**
 - Digital Innovation Board**
- The Alliance establishes the Digital Innovation Board to provide **strategic guidance, expertise and advocacy regarding its mission of building critical local enablers and fostering innovation and entrepreneurship in digital development** to create a more inclusive and equitable digital future for all.

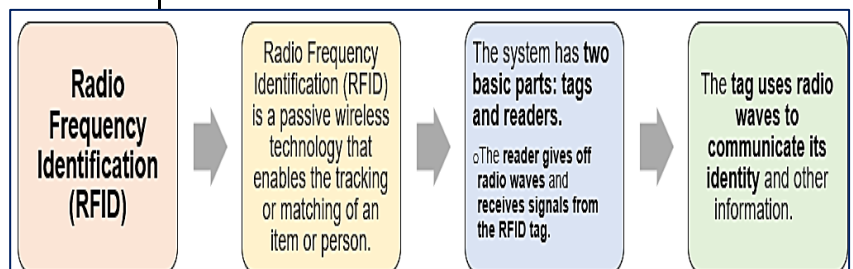
MIT researchers unveil terahertz anti-tampering tags.

News Excerpt:

MIT researchers have developed a new iteration of their **anti-tampering ID tag using terahertz waves.**

About the terahertz anti-tampering ID tag:

- This tiny tag is said to be significantly **smaller and cheaper than RFIDs.**



- It **addresses** a major **vulnerability** by **incorporating microscopic metal particles into the glue** that adheres the tag to an object.
- The **terahertz waves** are then **used to detect the unique pattern formed by these particles on the item's surface**, creating a fingerprint-like authentication system.
- Unlike previous terahertz tags, the **new anti-tampering tag prevents counterfeiting by destroying the authentication pattern** when the tag is peeled off and reattached to a fake item.
- The **metal particles act as mirrors for terahertz waves**, producing a distinct reflected pattern that is impossible to duplicate once the glue interface is compromised.
- The **tag's affordability and small size make it suitable for application** to items too small for traditional RFIDs, such as certain **medical devices**.
- To **enhance the authentication process**, the researchers also developed a machine-learning model with over 99% accuracy, capable of detecting tampering by comparing glue pattern fingerprints.
- Despite limitations, such as a short optimal distance between the tag and sensor, the researchers plan to address these challenges in future work, showcasing the versatility of terahertz waves beyond broadband wireless applications.

About Terahertz waves:

- Terahertz waves, also known as T-waves, are **electromagnetic waves** with a **frequency of the order of 10^{12} Hertz** located between **microwaves and infrared rays in the electromagnetic spectrum**.
- The use of the electromagnetic spectrum in the terahertz range is called terahertz spectroscopy.

India's first fully indigenous hydrogen fuel cell Catamaran ferry vessel.

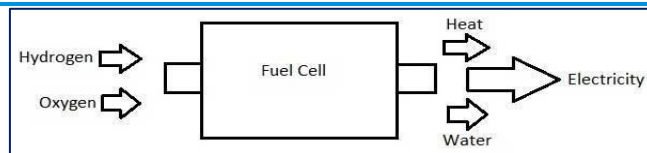
News Excerpt:

Recently, India's Prime Minister virtually launched the **country's first indigenous green hydrogen fuel cell inland waterway vessel** under the **Harit Nauka initiative** - a pilot project aimed at showcasing the technology for the maritime sector.

About the hydrogen fuel cell catamaran ferry vessel:

- The vessel has been **constructed** by **Cochin Shipyard Ltd.**
- Fuel cell-powered vessels **cause zero emission, zero noise and are energy efficient, which mitigate the effects of global warming.**
- Cochin Shipyard has embarked on the ambitious mission **to design, develop, and build** the country's first fully indigenous hydrogen fuel cell catamaran ferry vessel as a pilot project to demonstrate the technology in the maritime sector.

About Hydrogen Fuel Cell:



- Hydrogen fuel cells are a **clean, reliable, quiet, and efficient source of high-quality electric power.**
- They use **hydrogen as a fuel to drive an electrochemical process that produces electricity, with water and heat as the only by-products.**
- **Applications** are **stationary power sources and hydrogen fuel cell vehicles (FCVs).**
- **Hydrogen** is an **abundant constituent element in water, biomass, and fossil hydrocarbons.**
- The **greenhouse gas intensity** (and other environmental impacts) of **hydrogen production depends on the sources** and processes through which the hydrogen is derived.
- It can be **extracted from water using electrolysis, renewable solar or wind power, nuclear energy, or fossil energy.**
- It can be **extracted from renewable biomass or coal using high-temperature gasification.**
- Using chemical catalysts, it can also be derived from renewable biogas, renewable ethanol or methanol, or fossil natural gas.
- **Most hydrogen is derived from fossil natural gas, emitting fossil carbon dioxide as a by-product.**

About Harit Nauka initiative:

- The Government envisions a **complete transition to Green Vessels by 2047** with the objectives of -
- Developing and **operationalizing new-age vessels** with standardized designs/ infrastructure that are green and safe
- Creating an enabling ecosystem for the operation of such Green Vessels
- Promoting safe, convenient and green inland waterway-based passenger transport
- Developing indigenous capacity and promoting **"Make in India"** policy in shipbuilding
- Enabling financial assistance for the development of Green Vessels and related ecosystem

First ever "Made in India ASTDS tug"

News Excerpt:

The Union Minister of the Ministry of Ports, Shipping & Waterways (MoPSW) **inaugurated** the 60T bollard pull tug named '**Ocean Grace**' and the Medical Mobile Unit (MMU).

About the Newly Made in India ASTDS Tug:

- Tugs are special boats that assist other vessels into and out of port.
 - The **primary purpose** of these boats is to help **move larger ships** by towing, pushing, and guiding.

- Many even have fire suppression and other systems to help the larger ships.
- The first Approved Standard Tug Design and Specifications (ASTDS) tug is powered by **NIGATA main engines** and a Power Z-Peller ZP Propulsion engine.

About the Medical Mobile Unit (MMU):

- It is part of the port’s corporate social responsibility (CSR) commitment.
- Staffed with **skilled medical professionals**, including doctors, nurses, technicians, and pharmacists, the MMU offers various services, such as maternal and paediatric care, disease management, and health awareness programs.
- Its mobility **ensures healthcare** reaches those in need across Paradip and its surrounding areas.

About the Green Tug Transition Program (GTTP):

- The **MoPSW** launched the 'Green Tug Transition Programme' (GTTP), which will **convert all tugboats** working in the country into '**Green Hybrid Tugs**', running on **non-fossil fuels** like **Methanol, Ammonia, and Hydrogen**.
 - GTTP will first convert tugs into green hybrid tugs powered by hybrid propulsion systems and subsequently adopt non-fossil fuel solutions.
 - The plan is to make India the '**Global hub for building Green Ships**' by **2030**.
- The ministry has set a target for the initial green tugs to start working in all major ports by 2025.
- Under the GTTP, India’s first Centre of Excellence in Green Port & Shipping (**NCoEGPS**) resulted from a collaboration between the **MoPSW, GoI**, and the Energy and Resources Institute (**TERI**), the NCoEGPS will act as the **Nodal entity** for the industry.

IceCube: neutrino-spotter

News Excerpt:

Scientists reported they had found instances in **IceCube’s data from 2011 to 2020** that **matched** the signature of **tau neutrinos**, with more than 99.999999% confidence.

About the IceCube Neutrino Observatory:

- It is the **world’s biggest ‘neutrino telescope’**, designed to observe the cosmos from deep within the Antarctic **South Pole** ice.
- It is buried beneath a **cubic kilometre of surface**, extending to a **depth of about 2,500 meters**.
 - A surface array, **IceTop**, and a denser inner sub-detector, **DeepCore**,

enhance the capabilities of the observatory, making it a **multipurpose facility**.

- It was built and is maintained by the **IceCube Collaboration**.
- The National Science Foundation (**NSF-USA**) provided the **primary funding** and the **University of Wisconsin–Madison** is the **lead institution**, responsible for the maintenance and operations of the detector.

Working of IceCube:

- When a **neutrino interacts with the ice** surrounding the sensors, it may **produce some charged particles** and some **radiation**.
- The **sensors detect the radiation** to infer the detection of a neutrino and use the radiation’s properties to understand more about the particle.
- Neutrinos come in different types. IceCube can **identify some of them** in real-time.
 - For others, IceCube **collects data for many years** and scientists then comb through them to find neutrino interaction events.
- IceCube also **observes cosmic rays** that interact with the Earth’s atmosphere, which have revealed fascinating structures that are not presently understood.

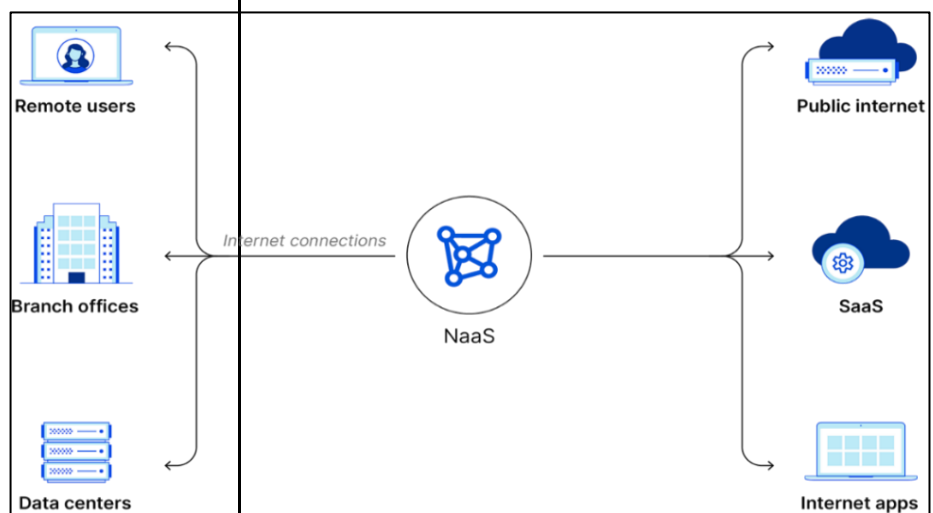
About Neutrinos:

- Neutrinos are light particles that very rarely interact with matter. This is why they’re called “**ghost particles**”.
 - These high-energy astronomical messengers **provide information** to probe the most **violent astrophysical sources**: events like exploding stars, gamma-ray bursts, and cataclysmic phenomena involving black holes and neutron stars.
 - Scientists named the **three types of neutrinos** they have discovered so far for the other matter particle they interact with: the **electron neutrino, muon neutrino, and tau neutrino**

Network-as-a-service

News Excerpt:

Network-as-a-service (NaaS) provider **CloudExtel** has secured its **first external debt funding of Rs 200 crore**.



About Network-as-a-Service (NaaS):

- It stands as a cloud service model wherein **clients lease networking services from providers.**
- With NaaS, customers can **manage their networks without the burden of maintaining physical infrastructure.**
- Operated through software by vendors, NaaS enables companies to **establish networks solely through Internet connectivity, eliminating the need for hardware.**
- It serves as a **modern alternative to traditional networking setups** like VPNs and MPLS connections, as well as on-premise hardware such as firewalls and load balancers.
- This innovative approach to **routing traffic and enforcing security policies** has significantly reshaped enterprise networking architecture.

- Developments have **influenced its evolution in neurology, psychiatry, psychology, philosophy, and the social and natural sciences.**
- It **aims to give people greater agency by facilitating awareness of their unconscious wishes and defences.**
- According to psychoanalysis, the therapeutic relationship is itself a change mechanism.

What is the unconscious?

- The unconscious is conceptually **central to psychoanalytic theory.**
- Freud posited that **certain memories and associated effects are cut off from consciousness because of their threatening nature.**
- **Repression** is an important **psychoanalytic construct characterized by the unconscious forgetting of painful ideas or impulses to protect the psyche.**

Psychoanalysis

News Excerpt:

The **six individuals accused in the Parliament breach incident** underwent **psychoanalysis to ascertain their motives.**

About Psychoanalysis:

- Psychoanalysis isn't a form of psychotherapy but, in fact, a worldview. It was the **first modern Western system of psychotherapy.**
- The Viennese psychiatrist **Sigmund Freud** coined the term and **developed psychoanalysis as a treatment modality for people presenting with symptoms** that other physicians were unable to treat.

SPACE

Six space missions to be excited for in 2024

News Excerpt:

The year 2023 proved important for space missions, with **NASA's OSIRIS-REx mission** returning a sample from an asteroid and **India's Chandrayaan-3 mission** exploring the lunar south pole region.

More about the news:

Several new missions under NASA's Artemis plan and Commercial Lunar Payload Services initiative will target the Moon.

Six Space Missions for Moon Exploration in 2024

Space Missions	Key points	Other Important Points
Europa Clipper	NASA will launch Europa Clipper, exploring one of Jupiter's largest moons, Europa.	<ul style="list-style-type: none"> • Europa is slightly smaller than the Earth's Moon, with a surface made of ice. • Beneath its icy shell, Europa likely harbours a saltwater ocean, which scientists expect contains over twice as much water as all the oceans here on Earth combined. • With Europa Clipper, scientists will investigate whether Europa's Ocean could be a suitable habitat for extraterrestrial life.
Artemis II launch	Artemis II is the first crewed step in this plan, with four astronauts planned to be on board during the 10-day mission.	<ul style="list-style-type: none"> • The mission builds upon Artemis I, which sent an uncrewed capsule into orbit around the Moon in late 2022. • The Artemis programme, named after Apollo's twin sister in Greek mythology, is NASA's plan to return to the Moon. • Artemis II will put the astronauts into orbit around the Moon before returning them home.

VIPER	VIPER, which stands for Volatiles Investigating Polar Exploration Rover , is a robot the size of a golf cart that NASA will use to explore the Moon's south pole in late 2024 .	<ul style="list-style-type: none"> • It will look for water on the Moon. • This robotic mission is designed to search for volatiles, which are molecules that easily vaporize, like water and carbon dioxide, at lunar temperatures. These materials could provide resources for future human exploration on the Moon. • The VIPER robot will rely on batteries, heat pipes, and radiators throughout its 100-day mission.
Lunar Trailblazer and PRIME-1 missions	NASA has recently invested in a class of small, low-cost planetary missions called SIMPLEx, which stands for Small, Innovative Missions for Planetary Exploration .	<ul style="list-style-type: none"> • These missions save costs by tagging along on other launches as what is called a rideshare or secondary payload. • One example is the Lunar Trailblazer. Like VIPER, the Lunar Trailblazer will look for water on the Moon. • PRIME-1 will drill into the Moon – it's a test run for the kind of drill that VIPER will use.
JAXA's Martian Moon eXploration (MMX) mission	The Japanese Aerospace Exploration Agency, or JAXA , has a robotic mission in development called the Martian Moon eXploration, or MMX , planned for launch around September 2024.	<ul style="list-style-type: none"> • The JAXA MMX mission concept is to study Phobos and Deimos, Mars' moons. • While the Earth's Moon has many visitors – big and small, robotic and crewed – planned for 2024, Mars' moons Phobos and Deimos will soon be getting visitors as well. • The mission's main science objective is to determine the origin of Mars' moons.
ESA's Hera mission	Hera is a mission by the European Space Agency (ESA) to return to the Didymos-Dimorphous asteroid system that NASA's DART mission visited in 2022 .	<ul style="list-style-type: none"> • Hera will launch in October 2024, making its way in late 2026 to Didymos and Dimorphous, where it will study the physical properties of the asteroids.

ISRO's Aditya-L1 was successfully placed in a halo orbit around the L1 point

News Excerpt:

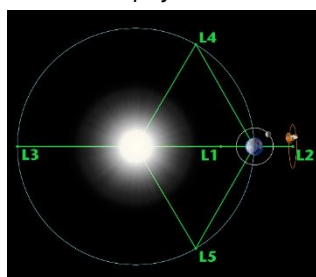
The Indian Space Research Organisation (ISRO) has **placed the Aditya-L1 spacecraft in a halo orbit around the Lagrangian point (L1)**.

Key Points:

- Aditya-L1, the first Indian space-based observatory to study the Sun, was launched on September 2, 2023, from the Satish Dhawan Space Centre in Sriharikota.
- After a 1.5 million km journey, the spacecraft was placed in a **halo orbit around L1**.
- The **Polar Satellite Launch Vehicle- C57 (PSLV-C57) carried the solar probe into space**.
- Aditya-L1 presents a unique opportunity to address the existing gaps and complement newer data to address the unsolved problems in solar physics.

Objectives of Aditya L-1 mission:

- The mission's main objective is to expand our knowledge of the Sun and how its radiation, heat, flow of particles, and magnetic fields affect us.



- **Below is the list of objectives that the mission will embark upon:**
 - Study of **Solar upper atmospheric (chromosphere and corona) dynamics**.
 - Study of **chromospheric and coronal heating**, partially ionized plasma physics, coronal mass ejections initiation, and flares.
 - Observe the in-situ particle and plasma environment, providing data for studying particle dynamics from the Sun.
 - Physics of solar corona and its heating mechanism.
 - Diagnostics of the coronal and coronal loops plasma: Temperature, velocity and density.
 - Development, dynamics and origin of **Coronal Mass Ejections (CMEs)**.

Space agencies of different countries exploring the Sun	
NASA (USA)	Parker Solar Probe
JAXA (Japan)	HINOTORI, HINODE
ESA (Europe)	ULYSSES, PROBA-3, SMILE
China	ASO-S
NASA + ESA	The Solar Orbiter

- Identify the sequence of processes that occur at multiple layers (chromosphere, base and extended corona) that eventually lead to solar eruptive events.
- Magnetic field topology and magnetic field measurements in the solar corona.
- Drivers for space weather (origin, composition and solar wind dynamics).

Meet ISRO's new X-ray eye in the sky

News Excerpt:

The successful launch of the **X-ray Polarimeter Satellite (XPoSat)** by the Indian Space Research Organisation (ISRO) ushers in a new era of astronomical exploration.

This innovative payload, entirely indigenous in design and fabrication, promises to unlock profound cosmic secrets through its cutting-edge instrument, the **Indian X-ray Polarimeter (POLIX)**.

Key points:

- **XPoSat (X-ray Polarimeter Satellite)** is India's first dedicated polarimetry mission to study various dynamics of bright astronomical X-ray sources in extreme conditions.
- XPoSat is the world's second satellite-based mission to make X-ray polarimetry measurements.
- Its launch vehicle was **ISRO's PSLV-C58**.

Mission Objective:

The primary goal of XPoSat is **to study the polarization of X-rays coming from bright celestial sources in the medium frequency band**. This is achieved through two scientific payloads: **POLIX and XSPECT**, developed by institutions in Bengaluru.



Payloads on XPoSat:

- **POLIX:** It is the world's first instrument operating in the 8 to 30 keV energy band. It includes a collimator and four X-ray proportional counter detectors to observe astronomical sources, particularly those emitting polarized X-rays.
 - It will observe a few tens of astronomical sources.
 - It was conceived, designed, and built at **Raman Research Institute (RRI), Bangalore**.
- **XSPECT:** It is designed for fast timing and high spectroscopic resolution in the 0.8-15 keV energy band. It observes various sources such as X-ray pulsars, black hole binaries, neutron stars, AGNs, and magnetars.

TYPE	PAYLOAD	CAPABILITY
Remote Sensing Payloads	Visible Emission Line Coronagraph (VELC)	Corona/Imaging & Spectroscopy
	Solar Ultraviolet Imaging Telescope (SUIT)	Photosphere and Chromosphere Imaging- Narrow and Broadband
	Solar Low Energy X-ray Spectrometer (SoLEXS)	Soft X-ray spectrometer: Sun-as-a-star observation
	High Energy L1 Orbiting X-ray Spectrometer (HEL10S)	Hard X-ray spectrometer: Sun-as-a-star observation
In-situ Payloads	Aditya Solar Wind Particle Experiment (ASPEX)	Solar wind/ Particle Analyzer Protons and heavier Ions with directions
	Plasma Analyser Package for Aditya (PAPA)	Solar wind/ Particle Analyzer Electrons and heavier Ions with directions
	Advanced Tri-axial High-Resolution Digital Magnetometers	In-situ magnetic field (Bx, By and Bz)

Significance of XPoSat:

- XPoSat will be a game-changer in enabling X-ray polarization measurements from bright sources, specifically in the medium energy band (8-30 keV), which has not been attempted previously.
- The invaluable data collected by XPoSat holds the potential to reshape our understanding of pulsars, black holes, and other enigmatic cosmic phenomena, pushing the boundaries of astrophysical knowledge.

POLIX's Role in Astrophysical Exploration:

- XPoSat's POLIX is a complementary asset to global efforts in X-ray polarimetry.
- While previous attempts with balloon-borne instruments paved the way, recent endeavours like NASA's Imaging X-ray Polarimetry Explorer (IXPE) highlight the growing interest in this field.
- POLIX's unique capabilities promise to fill crucial gaps in understanding polarized X-rays from cosmic sources, offering a new lens to observe and decode celestial mysteries.

SETI & METI

News Excerpt:

Search for Extraterrestrial Intelligence (SETI) is as fascinating for the casual observer as it is for an engaged specialist.

Search for Extraterrestrial Intelligence (SETI):

- It is a scientific adventure that aims to discover life on other planets, particularly intelligent beings, with technological advancements equal to our own.


Radio Signals vis-a-vis Neutrino Signals:

- Researchers use electromagnetic wave signals across the cosmos to identify ourselves and others, ranging from narrow-frequency radio signals to wideband signals.
- Scientists are exploring the possibility of extraterrestrial intelligence communicating with us


through **neutrinos, the most abundant particles in the universe after photons.**

- Neutrinos are subatomic particles. After photons, light particles are the most abundant particles in the universe.
- Neutrinos interact weakly with matter and can move relatively untouched through the same media as electromagnetic waves.
- SETI and METI programs have collaborated on scientific initiatives to increase technical understanding and literacy of human longevity and sustenance on multigenerational timescales.


Messaging Extraterrestrial Intelligence (METI)




It is a scheme to communicate with intelligent alien life in outer space. It began in 1960 and has evolved over the years.



NASA launched Pioneer 10 and 11 spacecraft in 1972 and 1973 to study the outer Solar System. Each spacecraft carried a plaque depicting human bodies, hydrogen atom properties, cosmic landmarks, and an image of the spacecraft.



In 1974, scientists like Frank Drake and Carl Sagan encoded a graphical message into radio waves and broadcasted it to the M13 globular cluster.



METI has gained momentum in recent decades with satellites and astronomy programs aiming to find exoplanets orbiting other stars.

SKA project

News Excerpt:

Recently, India has officially become a part of the **Square Kilometer Array (SKA)** project.

India's involvement in the SKA project:

- India has been actively engaged in the SKA project since its inception in the 1990s, playing a **key role in the telescope's design and development.**
- Additionally, India played a crucial part in negotiating the SKA Observatory Convention, the international treaty establishing the facility as an intergovernmental organization.
- The primary contribution from India involves developing and operating the Telescope Manager,

SKA project

- The Square Kilometer Array (SKA) project is an international effort to build the **world's largest radio telescope**, with eventually over a square kilometre (one million square meters) of collecting area.
- As one of the largest scientific endeavours in history, the SKA will bring together a wealth of the world's finest scientists, engineers and policymakers to bring the project to fruition.

essentially the **'neural network'** or software responsible for running the entire facility.

Leif Erikson Lunar Prize awarded to ISRO for Chandrayaan-3

- ISRO has been awarded the 2023 Leif Erikson Lunar Prize by the Exploration Museum in Iceland's Husavik for its successful Chandrayaan-3 mission.
 - The award celebrates the first soft landing of a spacecraft near the lunar south pole.

About Leif Erikson Lunar Prize:

- The Leif Erikson Award is an annual prize from the Exploration Museum in Husavik, Iceland, since 2015.
- It is named after Leif Erikson - a Norse explorer thought to be the first European to set foot on continental America, almost four centuries before the expedition of Christopher Columbus.
- It reveres trailblazers in the realm of lunar exploration, commemorating their significant contributions to humanity's quest for celestial understanding.

FEAST Software

News Excerpt:

The Vikram Sarabhai Space Centre (**VSSC**) of the Indian Space Research Organisation (**ISRO**) has developed an **analysis software** called **FEAST (Finite Element Analysis of Structures).**

About FEAST:

- FEAST (Finite Element Analysis of Structures) is the **structural** and **heat transfer** analysis software based on the **finite element method** realized by Vikram Sarabhai Space Centre.
- It is supported by state-of-the-art pre/post processor - **PreWin**. Its **sub-structured** and **multi-threaded** solver implementation ensures **high performance** by exploiting the multi-core architecture of modern computing platforms.
- The software can be deployed in **Linux** and **Windows** operating systems.
- It is available in **three versions**. The classification is based on the number of **finite element nodes** viz; **Academic** (for students and educational institutions), **Premium** (for small and medium scale industries) and **Professional** (for general large-scale applications).
- The book **Introduction to Finite Element Analysis** by ISRO covers the basic concepts and applications of FEA in an easy-to-understand manner.

Significance of FEAST:

- It has **real-life applications** in **structural engineering, solid mechanics** and **heat transfer problems** of Aerospace, Automobile, Civil, Mechanical and Marine engineering.

- It **performs** Finite Element Analysis (**FEA**) of various structures, including rockets, aircraft, satellites, buildings, etc.
- The **cost** of owning the software is a **fraction** of the price compared to similar non-indigenous software packages.

Finite Element Analysis (FEA):

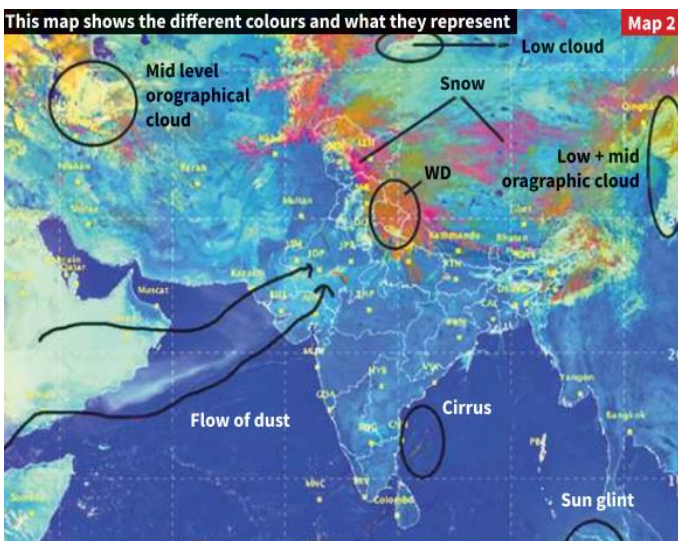
- It is a **computerized method** to **predict** how a **structure reacts** to real-world forces, such as structural loads and thermal conditions.
- It is **used** during a product's **design and development phase** to evaluate its **safety** and **ability** to withstand various loads without failure.

How satellites track weather

News Excerpt:

The Kalpana 1 and INSATs 3A, 3D, and 3DR satellites have bolstered India's weather monitoring and warning services.

How do satellites obtain images of fog from space?



- According to a paper published by IMD scientists, the **INSAT 3D satellite** has a **red-green-blue, or RGB, imager** whose **images' colours** are determined by **two factors: solar reflectance** and **brightness temperature**.
- **Solar reflectance** is the **ratio of the amount of solar energy reflected by a surface and the amount of solar energy incident on it**.
- **Brightness temperature** means the **relationship between an object's temperature and its surface's corresponding brightness**.

INSAT 3D:

- INSAT-3D is a dedicated **meteorological spacecraft designed for enhanced meteorological observation and monitoring of land and ocean surfaces for weather forecasting and disaster warning**.

- It was **launched on July 26, 2013**, with a **lift of mass of about 2100 kg** by **ARIANE-5/GSLV-MK II /Soyuz launcher**.

INSAT 3DR:

- INSAT-3DR, similar to INSAT-3D, is an **advanced meteorological satellite** of India configured with an **imaging System and an Atmospheric Sounder**.
- The significant improvements incorporated in INSAT-3DR are:
 - **Imaging in the Middle Infrared band** to provide nighttime pictures of low clouds and fog;
 - **Imaging in two Thermal Infrared bands** for estimation of Sea Surface Temperature (SST) with better accuracy;
 - **Higher Spatial Resolution** in the Visible and Thermal Infrared bands.

Kalpana 1:

- **METSAT** (renamed as Kalpana - 1 on February 5, 2003, after the Indian-born American Astronaut Dr. Kalpana Chawla, who died on February 1, 2003, in the US Space Shuttle Columbia disaster) is the first in the series of **exclusive meteorological satellites built by ISRO**.
- It provides the first set of transponders for **Swaran Jayanti Vidya Vikas Antariksh Upagraha Yojana (Vidya Vahini)** for interactive training and developmental communication, giving fillip to the training and developmental Communication channel of INSAT.

INSAT 3DS (Upcoming):

- In February 2024, the Indian Space Research Organisation is expected to launch the INSAT 3DS **meteorological satellite onboard its GSLV Mk II launch vehicle, with a launch mass of two tonnes**.

Peregrine Lander

News Excerpt:

The Peregrine One mission aims to locate water molecules on the Moon, has now **developed a critical fuel leak**.

About the program:

- Astrobotic is the first of three US companies to send a lander to the Moon this year under a new private-public partnership with NASA.



- It will be the first American spacecraft to attempt to land on the Moon in more than half a century.
- Peregrine will touch down on a mid-latitude region of the Moon called **Sinus Viscositatis, or Bay of Stickiness**. It lies adjacent to the **Gruithuisen Domes near the Oceanus Procellarum, or Ocean of Storms**.

- Astrobotic is one of 14 vendors eligible to carry NASA payloads to the Moon through the **CLPS initiative**.
- The mission's scientific objectives are to study the lunar exosphere, thermal properties, and hydrogen abundance of **the lunar regolith, magnetic fields, and the radiation environment**.

Commercial Lunar Payload Services (CLPS)

- NASA is working with several American companies to deliver science and technology to the lunar surface through the CLPS initiative.
- It began in 2018 and is designed to establish a commercial marketplace for science, exploration, and technology development investigations on the Moon's surface and in lunar orbit.
- These companies, ranging in size, bid on delivering payloads for NASA.

AstroSat Observation about SGR J1830-0645

News Excerpt:

AstroSat has detected bright **sub-second X-ray bursts** from a new and unique neutron star with an **ultrahigh magnetic field (magnetar)**.

- It can help understand the intriguing extreme astrophysical conditions of magnetars.

About Magnetars:

- Magnetars are neutron stars with an ultrahigh magnetic field that are much stronger than the terrestrial magnetic field.
- The magnetic field of a magnetar is over **one quadrillion time stronger than Earth's magnetic field**. Besides, magnetars display **strong temporal variability**, typically including a slow rotation, a rapid spin-down, and bright but short bursts going on up to months-long outbursts.
- One such magnetar, called **SGR J1830-0645**, was discovered in **October 2020** by NASA's Swift spacecraft.
 - It is relatively young (about 24,000 years) and an isolated neutron star.
- **X-ray bursts** occur in low-mass X-ray binary systems where a neutron star and a low-mass main sequence star orbit around one another.

Key findings:

- Scientists from the **Raman Research Institute (RRI) and the University of Delhi** performed the timing and spectral analysis of **SGR J1830-0645** magnetar using two instruments onboard AstroSat- the **LAXPC and SXT**.
- It detected **67 short sub-second X-ray bursts**, with an average duration of **33 milliseconds**.
 - Of these bursts, the brightest one lasted for about 90 milliseconds.

AstroSat:

- India's first multiwavelength astronomical mission, **AstroSat**, was launched in **September 2015** by the **Indian Space Research Organization**.
- It comprises **five scientific instruments** that can simultaneously observe a source over a wide energy range from optical to hard X-rays—
 - **a scanning sky monitor,**
 - **an ultraviolet imaging telescope,**
 - **SXT (Soft X-Ray telescope),**
 - **LAXPCs (Large Area X-Ray Proportional Counter), and**
 - **a cadmium zinc telluride imager.**

High-Altitude Pseudo Satellite Vehicle (HAPS)

News Excerpt:

The National Aerospace Laboratories (NAL) in Bengaluru has successfully completed the first test of a **solar-powered pseudo satellite**.

About high-altitude pseudo satellite vehicle (HAPS):

- HAPS is a new-age unmanned aerial vehicle (UAV) that can significantly **increase India's surveillance and monitoring capabilities** in border areas.
- HAPS can fly at altitudes of 18-20 km from the ground, almost double the heights attained by commercial aeroplanes.
- It can generate solar power and remain in the air for months or even years, offering it the advantages of a satellite.
- It does not require a rocket to get into space.
- The cost of operating HAPS is **several times lower than that of a satellite** that is usually placed at least 200 km from the Earth.

Uses of HAPS:

- High-altitude flying instruments arose from the desire to continuously monitor border areas to detect changes or movements.
 - Battery-powered UAVs can remain in the air for a limited period of time and can scan relatively smaller areas.
 - Satellites placed in low-earth orbits and meant to observe the Earth usually move in their orbits and are not watching constantly.

HAPS in disaster situations:

- It can even provide **mobile communications networks in remote areas** if the normal networks get damaged due to calamity.

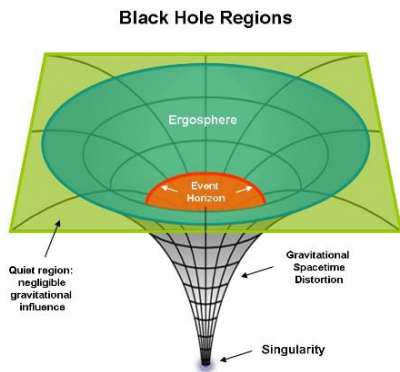
Ergosphere: Making a black hole work

News Excerpt:

Rotating black holes (a.k.a. Kerr black holes) have a unique feature: **a region outside their outer event horizon called the ergosphere**.

What is an Ergosphere?

- The ergosphere is the region wherein the **black hole has deformed** the spacetime continuum.
- **Just beyond the Event horizon sphere**, a rotating black hole will also have a bigger sphere that an object can enter and then leave if it's moving fast enough but still less than the speed of light.
- The term '**ergosphere**' comes from '**ergon**', the **Greek word for 'work**'.
- It is so named because it can extract matter and energy from the ergosphere.
- It's possible to explain the effects of gravity outside the ergosurface using Newtonian physics. However, inside it, the theories of relativity are needed.
- Some scientists have suggested using this possibility to **send an object into the ergosphere** and allow it to accelerate there along the black hole's direction of rotation so that **it comes out moving faster. This energy 'gain' will translate to the black hole losing some angular momentum.**



EVENT HORIZON	<ul style="list-style-type: none"> • It is a boundary marking the limits of a black hole. At the event horizon, the escape velocity is equal to the speed of light. • Since general relativity states that nothing can travel faster than the speed of light, nothing inside the event horizon can ever cross the boundary and escape beyond it, including light. • Thus, nothing that enters a black hole can get out or can be observed from outside the event horizon.
BLACK HOLE	<ul style="list-style-type: none"> • It is formed when a massive star runs out of fuel to fuse, and blows up, leaving its core to implode under its weight to form a black hole.
GRAVITATIONAL SINGULARITY	<ul style="list-style-type: none"> • The center of a black hole is a gravitational singularity, a point where the general theory of relativity breaks down, i.e. where its predictions don't apply.

Mars rover data confirms ancient lake sediments on the red planet

News Excerpt:

According to a new study published in the journal Science Advances, **NASA's rover Perseverance** has gathered data confirming the existence of **ancient lake sediments** deposited by water that once filled a giant basin on Mars called **Jezero Crater**.

Key findings:

- The findings from ground-penetrating radar observations conducted by the robotic rover substantiate previous orbital imagery and other data,

Perseverance Rover

It is part of NASA's Mars Exploration Program, a long-term effort of robotic exploration of the Red Planet.

A key objective for Perseverance's mission on Mars is astrobiology, including the search for signs of ancient microbial life.

The rover carries an entirely new subsystem to collect and prepare Martian rocks and sediment samples that includes a coring drill on its arm and a rack of sample titanium tubes in its chassis.

leading scientists to theorize that portions of Mars were once covered in water and may have harboured microbial life.

- It was based on subsurface scans taken by the car-sized, six-wheeled rover over several months of 2022 as it made its way across the Martian surface from the crater floor onto an adjacent expanse of braided, sedimentary-like features resembling, from orbit, the river deltas found on Earth.
- According to UCLA planetary scientists, soundings from the rover's **RIMFAX radar** instrument allowed scientists to peer underground to get a cross-sectional view of rock layers 65 feet (20 meters) deep, "almost like looking at a road cut".
- Those layers provide unmistakable evidence that soil sediments carried by water were deposited at Jezero Crater and its delta from a river that fed it, just as they are in lakes on Earth.
- The findings reinforced what previous studies have long suggested - that cold, arid, lifeless Mars was once warm, wet and perhaps habitable.
- Scientists look forward to an up-close examination of Jezero's sediments - thought to have formed some 3 billion years ago - in samples collected by Perseverance for future transport to Earth.
- Remote analysis of **early core samples drilled by Perseverance at four sites** close to where it landed in February 2021 revealed volcanic rock rather than sedimentary as had been expected.

NASA's Mars helicopter 'Ingenuity'

News Excerpt:

The National Aeronautics and Space Administration (NASA) **regained contact with its Mars helicopter Ingenuity after it could not communicate with it** towards the end of its 72nd flight on the red planet.

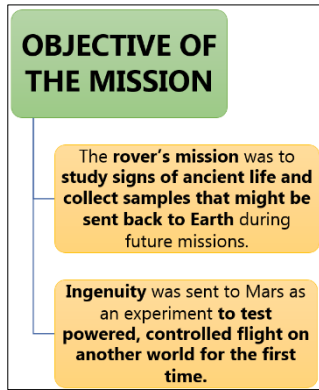
About the Mars Helicopter Ingenuity:

- In July 2020, **NASA launched a spacecraft towards Mars, carrying the Perseverance rover with Ingenuity attached to its belly.**
 - In February 2021, Perseverance successfully landed on the red planet.
- When the rover reached a suitable "airfield" location, it released Ingenuity to the surface.

- This **mini rotorcraft weighs just four pounds (1.8 kilograms)** and is about **1.6 feet (0.5 meters)** tall.
- It became the **first motorized craft to fly autonomously on another planet.**
- **Data from the helicopter is transmitted via Perseverance back to Earth.**

Why was Ingenuity’s flight on Mars a big deal?

- This was a big deal for **two reasons.**
 - **Firstly,** Ingenuity was the **first aircraft to fly on another planet.**
 - **Secondly,** it **managed to fly in Mars’ thin atmosphere,** which isn’t conducive for flying.
- Flight at Mars is **challenging** because the Red Planet has a **significantly lower gravity – one-third that of Earth’s** – and an **extremely thin atmosphere** with only **1% of the pressure at the surface compared to our planet.**
- This means there are relatively few air molecules with which Ingenuity’s two 4-foot-wide (1.2-meter-wide) rotor blades can interact to achieve flight.

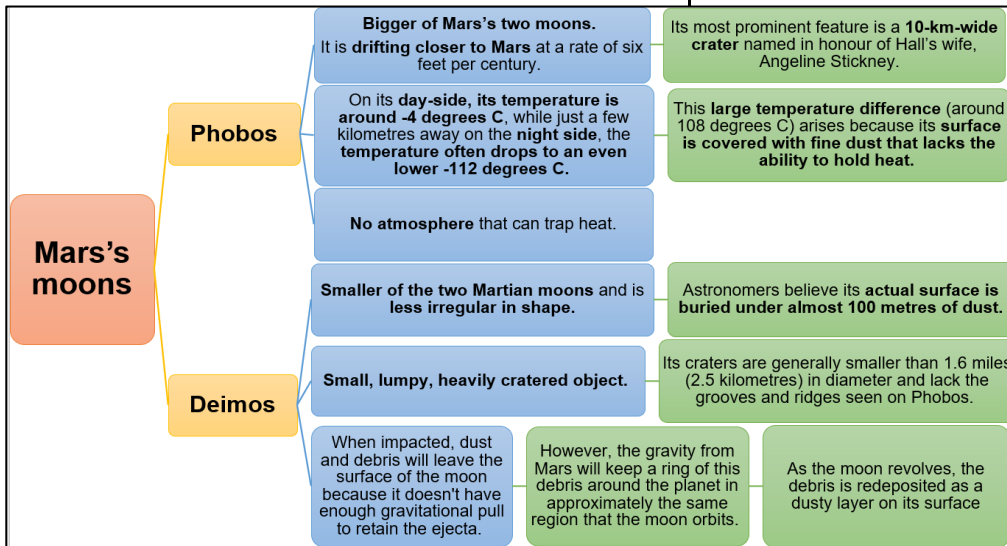


More about INSAT-3DS:

- INSAT-3DS Satellite is a follow-on mission of a Third Generation Meteorological Satellite to be placed at Geostationary Orbit.
- The Satellite is an exclusive mission designed for enhanced meteorological observations and monitoring of land and ocean surfaces for weather forecasting and disaster warning.
- The INSAT mission is fully funded by the Ministry of Earth Sciences (MoES).
- It was launched from the Satish Dhawan Space Centre in Sriharikota, Andhra Pradesh.
- It was lifted into orbit by the Geosynchronous Satellite Launch Vehicle (GSLV) rocket, designated GSLV-F14.
- INSAT-3DS will expand the country’s **meteorological (weather, climate, and ocean-related) capabilities** with the presently operational **INSAT-3D and INSAT-3DR** in-orbit satellites.

Objectives of INSAT-3DS:

- **The primary objectives of the mission are:**
 - To monitor Earth’s surface and carry out oceanic observations and its environment in various spectral channels of meteorological importance.
 - To provide the vertical profile of various meteorological parameters of the Atmosphere.
 - To provide the Data Collection and Data Dissemination capabilities from the Data Collection Platforms.



- To provide the Satellite Aided Search and Rescue services.
- INSAT-3DS aims to enhance the monitoring of **Earth’s surface, Atmosphere, oceans, and environment.**
- The initiative will boost India’s weather, climate, and ocean-related observations and services, expanding knowledge and better disaster mitigation and preparedness in the future.

Boost to NASA-ISRO mission:

- The success of the GSLV-F14/INSAT-3DS mission

is a big boost for ISRO ahead of the launch of the **NASA-ISRO Synthetic Aperture Radar (NISAR)** satellite.

- The NISAR will be launched by the GSLV Mark-II launch vehicle.

Third-generation weather satellite INSAT-3DS

News Excerpt:

Recently, the Indian Space Research organization (ISRO) launched **INSAT-3DS using GSLV-F14.**

Geosynchronous Satellite Launch Vehicle (GSLV):

- The Geosynchronous Satellite Launch Vehicle (GSLV) project was initiated in 1990 to acquire an Indian launch capability for geosynchronous satellites.
- GSLV is a three-stage launch vehicle.
 - The first and second stages consist of solid propellant, while the **third stage is a cryogenic stage with propellant loading of liquid oxygen (LOX) and liquid hydrogen (LH2).**
 - During the atmospheric regime, the Satellite is protected by Ogive payload fairing.
- GSLV can be used to launch a variety of spacecraft capable of performing communications, navigation, and earth resource surveys.
- The GSLV earned the moniker “naughty boy” due to encountering at least four unsuccessful launches out of its previous 15 missions.

- The 63 m (297 ft) H3 is designed to **carry a 6.5 metric ton payload** into space and **reduce the per-launch cost** to as low as five billion yen (\$33 million).
- The H3 is scheduled to deliver a lunar explorer for the joint **Japan-India LUPEX project in 2025** and cargo spacecraft for the **U.S.-led Artemis** moon exploration program in the future.

Fission Surface Power Project

News Excerpt:

Recently, NASA announced that it is finishing the **initial phase** of its ambitious plan to build a **small electricity-generating nuclear reactor on the Moon.**

About the Fission Surface Power Project:

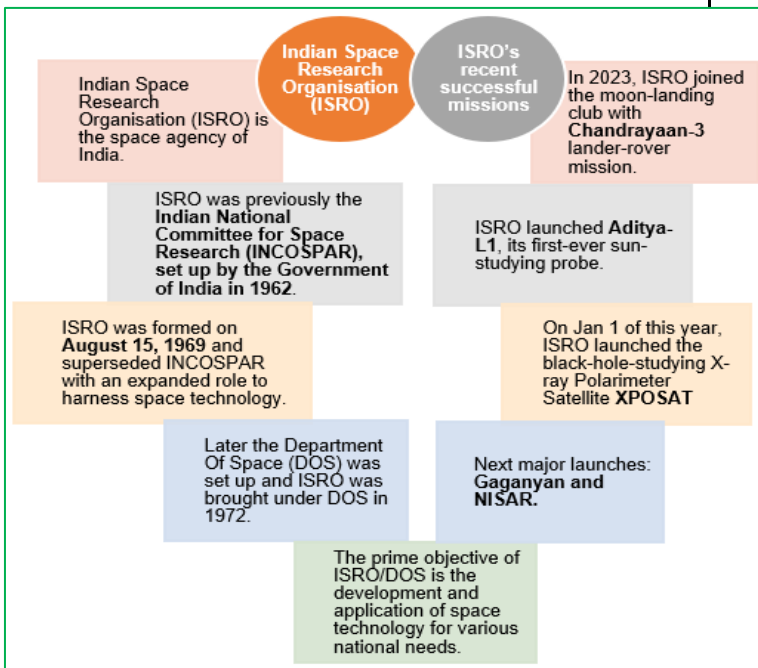
Fission surface power can provide abundant and **continuous power** regardless of environmental conditions on the **Moon and Mars.**

- The project aims to develop **safe, clean and reliable energy sources** on the **Moon.**
 - Such a system would play a big role in **NASA's Artemis program for lunar exploration.**
 - It is focused on developing concept designs for a **small, electricity-generating nuclear fission reactor** that could be used during a future demonstration on the Moon and to inform future designs for Mars.
 - Under this project, NASA is aiming to power a **sustained human presence** on the lunar surface for **at least 10 years.**
 - **NASA** worked with the Department of Energy (DOE, U.S.A.) and industry to design a fission power system that would provide at least **40 kilowatts of power** to continuously **run 30 households for ten years.**

Significance of the Nuclear fission reactor in the project:

- Solar power systems have limitations on the Moon; a nuclear reactor **could be placed in permanently shadowed areas** (where there may be water ice) and still **generate power continuously during lunar nights**, which are 14-and-a-half Earth days long.
- NASA's Fission Surface Power Project marks a **pivotal step in lunar exploration**, aiming to establish a **sustainable energy source** through nuclear fission.
 - By leveraging its partners' expertise, the project seeks to **overcome the limitations of solar power**, ensuring **continuous electricity supply** for future missions and prolonged human presence on the Moon.

Gamma Ray Astronomy PeV Energies phase-3 (GRAPES-3) Experiment



Japan's H3 Rocket

News Excerpt:

Japan's space agency recently successfully launched a second test model of its new flagship rocket, H3.

About the project:

- The **Japan Aerospace Exploration Agency (JAXA)** and primary contractor **Mitsubishi Heavy Industries** have designed the H3 to replace the two-decade-old H-IIA, hoping that its lower costs and greater payload capacity will help them win launch orders from global clients.
 - The H3's first flight in March ended with ground control destroying the rocket 14 minutes after liftoff because its second-stage engine failed to ignite.

About the H3 Rocket:

News Excerpt:

The GRAPES-3 experiment in Ooty, India, operated by the **Tata Institute of Fundamental Research**, has discovered a **new feature** in the **cosmic-ray proton spectrum**.

Key findings of the experiment:

- The GRAPES-3 experiment has discovered a **new feature in the cosmic-ray proton spectrum** at about **166 tera-electron-volt (TeV) energy** while measuring the spectrum spanning from **50 TeV** to a little over 1 peta-electron-volt (**PeV**).
- The observed feature suggests a potential **re-evaluation** of our **understanding of cosmic-ray sources, acceleration mechanisms, and their propagation** within our galaxy.

- The successful launch demonstrates Iran's determination to advance its space technology and highlights its progress in developing the necessary infrastructure and expertise for satellite technology.

Astronaut Wings for Gaganyaan's IAF Pilots

News Excerpt:

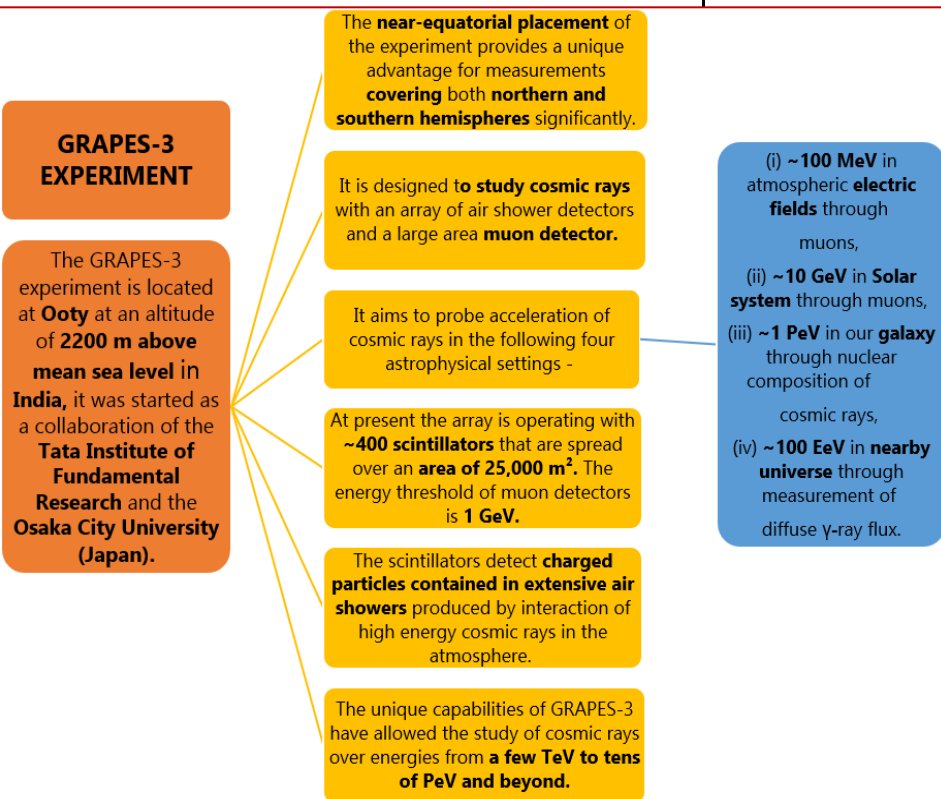
India announced the names of the **four astronaut designates for the Gaganyaan human spaceflight mission**, which is planned for launch in 2025.

More about the news:

- The names of the **Indian Air Force (IAF) pilots — Group Captain Prasanth Balakrishnan Nair, Group Captain Ajit Krishnan, Group Captain Angad Pratap and Wing Commander Shubhanshu Shukla** — were revealed for the first time in the presence of India's Prime Minister during his visit to the **Vikram Sarabhai Space Centre (VSSC) in Thiruvananthapuram**.

Crew training for Gaganyaan:

- Astronaut Training Facility established in Bengaluru caters to **Classroom training, Physical Fitness training, Simulator training and Flight suit training**.
- Training modules cover **academic courses, Gaganyaan Flight Systems, Micro-gravity familiarization through Parabolic Flights, Aero-medical training, Recovery & Survival training, mastering of Flight Procedures and training on Crew Training Simulators**.
- **Aero medical training, Periodic flying practice, and yoga** are also included in the training.



Sorayya Satellite

News Excerpt:

Iran has successfully launched its Sorayya satellite.

More about the launch:

- The Satellite, named Sorayya, **meaning the Pleiades in Persian**, was placed into orbit using domestically-made carrier Qaem 100. (a three-stage solid-fuel rocket built by the Islamic Revolutionary Guard Corps).
- **This is the first time that Iran has successfully placed a satellite in orbits higher than 500 kilometres (310 miles)**.
- **The Satellite was placed in an orbit at 750 kilometres (about 460 miles) above the Earth's surface with a three-stage rocket**.

Private Odysseus moon lander beams home 1st photos from space

News Excerpt:

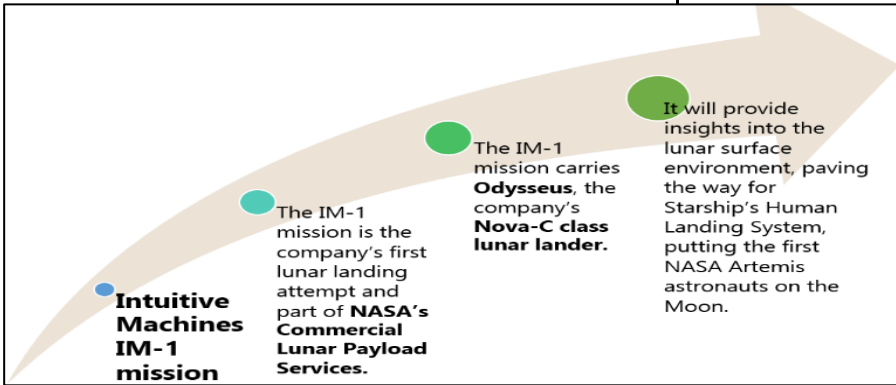
Shortly after launching on a **SpaceX Falcon 9 rocket**, **Intuitive Machines'** robotic Odysseus spacecraft **took a few selfies with Earth** in the background.

About moon lander Odysseus:

- This **private "Odysseus"** moon lander **built by Houston-based Intuitive Machines** was launched by SpaceX Falcon 9 rocket.
- The lander's **propulsion system** is powered by a **mixture of liquid methane and liquid oxygen**.
- Odysseus, also known as the **Nova-C** lander, is carrying **six NASA experiments and technology**

demonstrations, along with **six private payloads**, on its current IM-1 mission.

- In a previous study, **SOFIA found similar traces of water on the surface of the moon**, in one of the largest craters in its southern hemisphere.



About Stratospheric Observatory for Infrared Astronomy (SOFIA):

- SOFIA was a **Boeing aircraft** modified to carry a 2.7-meter reflecting telescope (with an effective diameter of 2.5 metres or 100 inches).

- **Flying into the stratosphere** at 38,000-45,000 feet put SOFIA above 99 percent of Earth's infrared-blocking atmosphere.

- If Odysseus completes its journey and soft lands on the Moon, it will make it the **first privately-led mission to do so**.
 - **Israel's Beresheet** attempted in 2019, **Japan's Hakuto** in 2023 and the **American Peregrine** in 2024. All of them failed to land on the Moon.
- The lander and its payloads are expected to function on the Moon for about seven days till the lunar night sets in.

- It allowed the astronomers to **study the solar system** and beyond in ways that are not possible with ground-based telescopes.
- SOFIA could observe the universe in the widest range of infrared light.
- It was a joint project between NASA and the German Space Agency DLR.

About Commercial Lunar Payload Services program:

- **CLPS** is the program that puts NASA's science instruments on private robotic moon landers like Odysseus.
- These instruments are **designed to collect data that will aid NASA's Artemis program**, which aims to establish a crewed base near the lunar south pole by the end of the 2020s.

ISRO to provide Internet in 80 remote tribal villages using V-SAT

News Excerpt:

The **Ministry of Tribal Affairs** plans to collaborate with the **Indian Space Research Organisation (ISRO)** to deploy **V-SAT stations** on a pilot basis for around 80 tribal villages to bring Internet services.

More about the news:

- A gap analysis conducted by the Ministry of Tribal Affairs identified approximately **18,000 tribal majority villages with challenging accessibility** due to remote locations and terrain.
- Inadequate **mobile and internet connectivity** hinders access to basic services in these areas.
- On a pilot basis, V-SAT stations will be installed in around 80 tribal villages in **Jharkhand, Madhya Pradesh, Odisha, and Maharashtra**.
- These are some of the geographically remote villages in the region and have difficult terrain.
- ISRO's satellite-based (V-SAT) solutions can significantly address these connectivity challenges. V-SAT stations can be **static or mounted on vehicles**.
- These stations will offer a **Wi-Fi capacity of 100 Mbps**, expandable to another 100 Mbps with boosters, enhancing connectivity and access to essential services for tribal communities.

VSAT (Very Small Aperture Terminal):

- A **Very Small Aperture Terminal (VSAT)** is a small-sized **earth station** used in the

Water detected on the surface of an asteroid for the 1st time ever

News Excerpt:

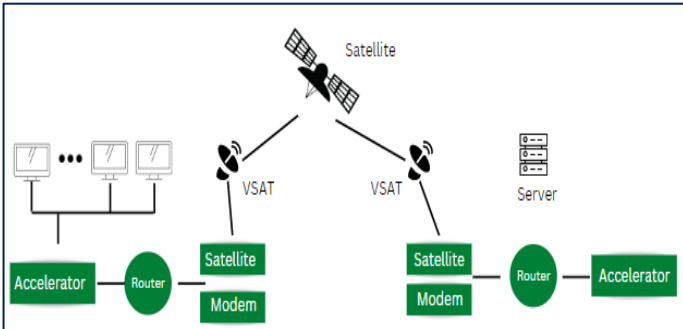
Scientists detected water molecules on the surface of two asteroids—named **Iris and Massalia** for the first time ever.

About new discovery:

- The team made the discovery using data from **NASA's now-retired SOFIA airborne observatory**.
- Observations showed that **two of the asteroids — named Iris and Massalia — exhibit a specific wavelength of light that indicated the presence of water molecules at their surface**.
- This proves that liquid water can survive on asteroids in the inner solar system for eons. And it is crucial for study on asteroids.
- **While water molecules have previously been detected in asteroid samples returned to Earth, this is the first time that water molecules have been found on the surface of an asteroid in space.**

transmission/reception of data, voice, and video signals over a satellite communication network

- A **VSAT consists of two parts: a transceiver** placed outdoors in direct line of sight to the satellite, and a **device that is placed indoors to interface the transceiver** with the end user's communications device, such as a PC.
- The term **'Very Small'** in VSAT (Very Small Aperture Terminal) **refers to the very small antenna size.**
- VSAT is of importance, especially in remote areas such as the hilly mountain regions, where Internet connectivity cannot be directly provided.



- The interaction between **charged particles emitted by the Sun and Venus's upper atmosphere leads to the gradual loss of ions**, such as hydrogen and oxygen, into space, contributing to the planet's atmospheric erosion over time.
- In 2021, the **BepiColombo mission** made significant discoveries during its **Venus fly-by**, about atmospheric escape mechanisms and Venus's evolutionary trajectory.

BepiColombo

A collaborative effort between the **European Space Agency (ESA)** and the **Japan Aerospace Exploration Agency (JAXA)**, embarked on its journey to Mercury in October 2018.

Comprises two spacecraft, the **Mercury Planetary Orbiter (MPO)** provided by **ESA** and the **Mercury Magnetospheric Orbiter (MMO)** provided by **JAXA**.

Aim:

- Orbit Mercury from the end of 2025 onwards.
- Provide unprecedented insights into the innermost planet and deepen our understanding of Mercury's origin, composition, geophysics, atmosphere, magnetosphere, and history.

Did you know Venus is leaking?

News Excerpts:

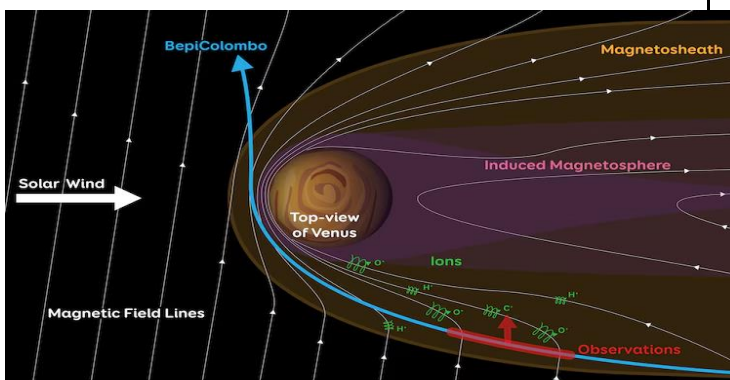
Recent studies have suggested that gases are escaping from Venus which explains the possible phenomenon of how the planet lost its water.

More About the News:

- Venus, often referred to as **Earth's "sister planet,"** or **Earth's "evil twin,"** shares similarities in size and composition.
- But it exhibits stark differences, notably in its **lack of liquid water on the surface due to its extreme temperatures** and thick carbon dioxide-rich atmosphere.
- However, evidence suggests that Venus might have hosted liquid water in the distant past.

Solar Wind Interaction and Atmospheric Loss:

- Venus's absence of a strong magnetic field exposes its upper atmosphere to the solar wind, resulting in atmospheric escape.



Future Exploration of Venus:

- Several upcoming spacecraft missions aim to investigate Venus and its environment further, promising to fill in many gaps in our understanding, including the
 - **Indian Space Research Organisation's Shukrayaan orbiter,**
 - **European Space Agency's Envision mission,**
 - **NASA's VERITAS orbiter and DAVINCI probe.**

First tidally locked super-Earth exoplanet confirmed

News Excerpt:

An international team of astronomers and astrophysicists has confirmed the first known observance of a tidally locked super-Earth exoplanet.

More about the news:

- Scientists have confirmed the existence of a **super-Earth exoplanet**, named **LHS 3844b**, that is **tidally locked to its star.**
- This means that **one side of the planet is always facing its star**, while the other side is perpetually turned away.

Tidal Locking:

- Tidal locking happens when an **object's orbital period matches its rotation period**, leading to the **same side always facing the planet or star it orbits.**
- Tidal locking is a natural consequence of the **gravitational distortions** induced by a body on another.

- The **Moon is tidally locked to the Earth** because it **rotates** in exactly the **same time as it takes to orbit the Earth**. That is why we **only see one side of the Moon**.
 - For this reason, the Moon has what is commonly described as a "**far side**"—the side we never see.

LHS 3844b:

- **LHS 3844b** is a **super Earth exoplanet** that orbits an **M-type star**.
- Its mass is **2.25** times that of **Earth**, it takes 0.5 days to complete one orbit of its star, and is 0.00622 AU from its star.
- Its **discovery** was announced in **2019**.

What is an Exoplanet?

- An exoplanet is any **planet beyond our solar system**.
- Most exoplanets orbit other stars, but free-floating exoplanets, called **rogue planets**, orbit the galactic center and are untethered to any star.

Tiantong Satellite

News Excerpt:

Chinese scientists have developed the world's first satellite capable of enabling smartphone calls directly **without the need for ground-based infrastructure such as mobile towers**.

About the news:

- The deployment of the Tiantong-1 series involves launching **three satellites orbiting synchronously at an altitude of 36,000 kilometers**. This has the potential to revolutionize communication across the Asia-Pacific region, from the Middle East to the Pacific Ocean.
- However, the realization of direct satellite connectivity for mobile phones posed **formidable technical challenges**, particularly concerning **passive intermodulation (PIM) interference**.

What is PIM?

- Interference resulting from the nonlinear mixing of two or more frequencies in a passive circuit. If the interference coincides with a network's base receive frequencies, it can cripple network performance.
- Lowers the reliability, capacity and data rate of cellular systems.
- Issue for cellular network operators: PIM issues may occur as existing equipment ages, when co-locating new carriers, or when installing new equipment. PIM is a particular issue when overlaying (diplexing) new carriers into old antenna runs.
- PIM can create interference that will reduce a cell's receive sensitivity or even block calls.

- PIM has **plagued commercial communication satellite networks**, hindering further technological advancements. In response, Chinese scientists spearheaded groundbreaking research to mitigate PIM effects.

Europa Clipper Mission

News Excerpt:

The **National Aeronautics and Space Administration (NASA)** is preparing the **Europa Clipper spacecraft** for a mega launch in October this year.

More about Europa Clipper mission:

- Europa Clipper is a **robotic solar-powered spacecraft** built to conduct the first **detailed investigations of Jupiter's icy moon Europa**.
- It is **NASA's Largest Planetary Mission Spacecraft**.



- The spacecraft will arrive at **Jupiter in 2030**. Once in orbit around Jupiter, it will conduct nearly **50 flybys of Europa**.
- Europa Clipper will launch in **October 2024** on a **SpaceX Falcon Heavy rocket** from Kennedy Space Center in Florida.

What will Europa Clipper do?

- The mission's **three main science objectives** are to understand the **nature of the ice shell** and the **ocean beneath it**, along with **Europa's composition and geology**.

Europa:

- Europa is the **sixth-largest moon in the Solar System** and **Jupiter's fourth-largest satellite**.
- Despite its cracked and discoloured appearance, it is the **smoothest solid object** in the **Solar System**.

SAKHI App

News Excerpt:

The Vikram Sarabhai Space Centre (VSSC), the Indian Space Research Organisation (ISRO) facility at Thumba in Thiruvananthapuram, has developed a **multi-purpose app** that will **help astronauts on the Gaganyaan space flight mission**.

About Space-borne Assistant and Knowledge Hub for Crew Interaction (SAKHI) app:

- It can carry out a range of tasks such as looking up vital technical information or communicating with one another.
- It will **monitor the astronauts' health**, help them **stay connected with Earth**, and even **alert them about their dietary schedules**.
- The **astronauts may need to look up technical documents** and training manuals at short notice during the mission.
 - SAKHI will **ensure that they have all the required data at their fingertips**.

- The astronauts can use the app to **maintain a log on the mission in multiple formats**, including **voice records, texts, and images**.
- This comprehensive system **provides information on key parameters** like **blood pressure, heart rate, and oxygen saturation**, providing invaluable insights into the crew's physical condition throughout their mission.
- SAKHI will **keep the crew connected with the onboard computer and ground-based stations**, guaranteeing a seamless communication link.
- The app will also **remind them about their hydration, dietary schedules, and sleep patterns**.

- The satellite was launched aboard **SpaceX's Falcon 9 rocket** as part of the **Bandwagon-1** mission from Kennedy Space Center, Florida, U.S.
- The **Bandwagon-1** mission was SpaceX's first dedicated **rideshare mission launched** into a **mid-inclination orbit**, offering a higher revisit rate for satellite imaging.
- The deployment is a result of TASL's collaboration with **Satellogic**, leveraging their expertise in developing and **integrating earth observation satellites**.

Applications:

- TSAT-1A will deliver **high-resolution optical satellite**

NASA's SOHO Mission

News Excerpt:

NASA's SOHO mission celebrates a milestone as it captures the 5,000th comet on its journey around the Sun.

About SOHO Mission:

- SOHO, the **Solar & Heliospheric Observatory** was launched on **December 2, 1995** with a package of **12 instruments onboard**.
 - The mission has 12 instruments, including **telescopes and spectrometers**, which observe the Sun in various wavelengths of light, **from ultraviolet to visible X-rays**.
- A joint project of the **European Space Agency (ESA) and NASA**. It is designed to **study the Sun, its atmosphere, and the solar wind**.
- It has provided knowledge into **the structure of the Sun, including its magnetic field, solar flares, coronal mass ejections (CMEs), and solar variability**.
- SOHO monitors the effects of space weather on our planet, and it plays a vital role in forecasting potentially **dangerous solar storms**.

Latest Findings:

- Now, the SOHO mission has **achieved a milestone in its journey by capturing its 5,000th comet** as it traverses around the solar star in our cosmic neighborhood.
- The latest comet, named **SOHO-5000**, belongs to the **Marsden group**.
 - It is a part of the **larger comet 96P/Machholz**.

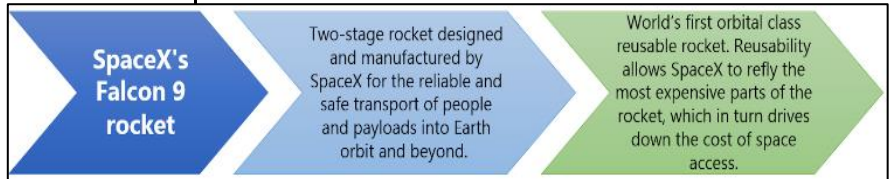
TSAT-1A Satellite

News Excerpt:

TASL announces successful deployment of **sub-metre resolution optical satellite TSAT-1A**.

Key points about Tata Advanced Systems' TSAT-1A satellite deployment:

- **Tata Advanced Systems Limited (TASL)** successfully deployed its **sub-metre resolution optical satellite, TSAT-1A, in space**.



images with increased collection capacity, dynamic range, and low-latency delivery through its **multispectral and hyperspectral capabilities**.

Military applications:

- Delivers **high-resolution imagery with precision less than 1 meter per pixel**, suitable for military/defence applications.
- Primary customers are the government and **armed forces**.
- TASL intends to establish a constellation of similar satellites in the future, with its manufacturing facility primed to produce up to **25 low earth orbit (LEO) satellites** for military purposes.

Ozone on Jupiter's moon Callisto

News Excerpt:

Strong evidence of ozone's presence on **Jupiter's moon Callisto** has been found by a team of scientists.

Callisto and its unique environment:

- After **Saturn, Jupiter** has the **most moons** in the **Solar System**.
 - **Callisto** is one of **Jupiter's largest moons and the third-largest moon** in the Solar System after **Ganymede and Titan**.
- Despite being as big as the planet Mercury, it has **less than half as much mass**.
 - Callisto is primarily composed of **water ice, rocky materials, sulphur dioxide**, and some **organic compounds**.
- Callisto's surface is heavily cratered, **indicating a long history of being struck by asteroids and comets**. (It may have the **oldest surface in the Solar System**).

Gaia mission

News Expert:

Astronomers have detected the largest stellar black hole in the Milky Way galaxy, with a **mass 33 times that of the Sun**. It is also the **second closest black hole to Earth**, sitting just **2,000 light years** away from the planet.

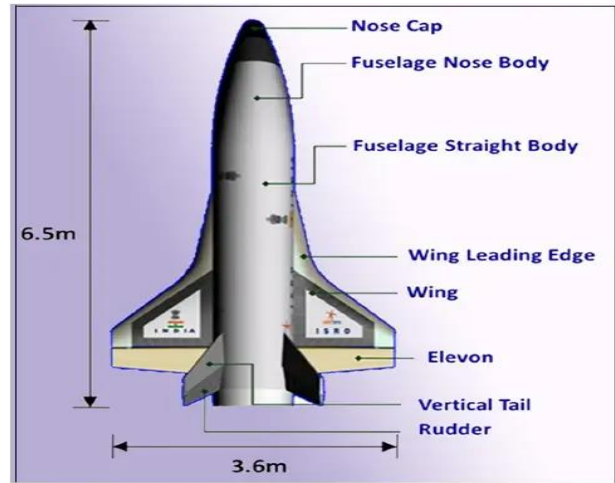
About the newly discovered stellar black hole "Gaia BH3":

- "Gaia BH3" stellar **black hole** has dethroned **Cygnus X-1**, which is **21 times as massive as the Sun**, to become the most massive black hole of stellar origin in the Milky Way.
- It sits in the **Aquila constellation**. Gaia is a Latin word that means **"the eagle"**.
- Nearly all **stellar black holes** were found because they **exist in binaries** or pair up with a **companion star**.
 - **Gaia BH3** was observed, causing an **odd 'wobbling' motion on the companion star orbiting it**.
- Researchers used data from ground-based observatories, including from the **Ultraviolet and Visual Echelle Spectrograph (UVES)** instrument on **ESO's VLT located in Chile's Atacama Desert**.
 - These observatories studied key properties of the companion star, which allowed astronomers to measure the mass of BH3 precisely.

About Gaia mission:

- Gaia was **launched in 2013** from the **European Spaceport in Kourou, French Guiana**, on a Soyuz-STB/Fregat-MT launch vehicle.
- Its **goal** was to **build our galaxy's largest, most precise three-dimensional map** by surveying nearly **two billion objects**.
- Gaia **monitors each of its target stars about 14 times per year**.
- Gaia is creating an extraordinarily **precise three-dimensional map of nearly two billion objects throughout our Galaxy** and beyond, mapping their **motions, luminosity, temperature and composition**.
- Gaia is achieving its goals by repeatedly **measuring the positions of all objects down to magnitude 20** (about **400,000 times fainter than can be seen with the naked eye**).

The **Indian Space Research Organisation (ISRO)** has reached a significant milestone in Reusable Launch Vehicle Technology with the successful landing experiment of the **RLV LEX-02**.



Key Points:

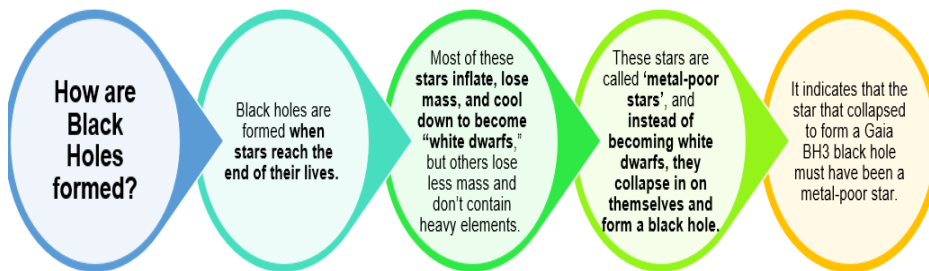
- The **RLV LEX-02 mission** demonstrated the autonomous landing capability of the reusable launch vehicle from challenging initial conditions after release from a helicopter.
- The experiment, conducted at the **Aeronautical Test Range in Chitradurga, Karnataka**.

About Pushpak:

- The **Pushpak RLV** is designed as an all-rocket, **fully reusable single-stage-to-orbit (SSTO)** vehicle, incorporating several major elements such as the **X-33 advanced technology demonstrator**.
 - The **X-34 testbed technology demonstrator**, and the upgraded DC-XA flight demonstrator.
- Pushpak demonstrated **autonomous landing capability** from off-nominal initial conditions at release from a helicopter.
- It performed difficult **manoeuvres with dispersions**, correcting both **cross-range** and **downrange** to precisely land on the runway.
- Pushpak was released from a height of **4.5 km by an Indian Air Force Chinook helicopter**, and it autonomously approached the runway from a **distance of 4 km**.

- The mission successfully simulated the approach and high-speed landing conditions of an **RLV returning from space**.

- The endeavour to launch RLV requires several **state-of-the-art technologies**. That also includes **accurate navigation hardware and software**, a **Pseudolite system**, **Ka-band Radar Altimeter**, **NavIC receiver**, **indigenous Landing Gear**, **Aerofoil honey-comb fins**, and **brake parachute system**.



Reusable Launch Vehicle (RLV) "Pushpak"

News Excerpt:

- The **winged vehicle** and all flight systems used in **RLV-LEX-01** were reused in the **RLV-LEX-02 mission** after proper certification/clearances, demonstrating the reuse capability of flight hardware and flight systems.
 - Based on observations from **RLV-LEX-01**, the airframe structure and landing gear were strengthened to **tolerate higher landing loads**.

What is RLV?

- An RLV is a vehicle that is launched into **space many times**. As the vehicle can be used for many relaunches, it goes a long way in mitigating costs.

DISEASES

Bubble Baby Syndrome - Severe Combined Immuno-deficiency (SCID)

News Excerpt:

A **two-month-old girl** with bubble baby syndrome has become one of the youngest patients in the country to undergo a **Bone Marrow Transplant (BMT)** from an unrelated donor.

About the Bubble Baby Syndrome:

- Severe Combined Immunodeficiency (**SCID**) is a group of **rare disorders** caused by mutations in different genes involved in the development and function of infection-fighting immune cells.
- **SCID is often called bubble baby disease**.
 - Most often, SCID is inherited in an **autosomal recessive pattern**, in which **both copies** of a **particular gene**—one inherited from the mother and one from the father—contain defects.
- Infants with SCID **appear healthy at birth** but have **no functioning immune system**, meaning that even a normally mild infection can be fatal.

Types of SCID:

- The **best-known form** of autosomal recessive SCID is caused by adenosine deaminase (**ADA**) deficiency, in which infants **lack the ADA enzyme** necessary for **T-cell survival**.
- **X-linked SCID**, which is caused by **mutations in a gene** on the **X chromosome**, primarily **affects male infants**.
 - Children with this type of SCID have **white blood cells** that grow and develop **abnormally**.
 - Consequently, they have **low numbers of T cells** (white blood cells that identify and attack perceived "invaders"), and their **B cells** (white blood cells that produce antibodies against infection) **do not function**.

Symptoms and Diagnosis:

- Symptoms of SCID occur in infancy and include **serious or life-threatening infections**, especially **viral infections**, which may result in **pneumonia** and **chronic diarrhoea**.

- Research supported by the National Institute of Allergy and Infectious Disease (**NIAID**), **USA** and other organizations has shown that **early diagnosis** of SCID through newborn screening leads to **prompt treatment** and **high survival rates**.

ONLY 1 IN 60K AFFECTED BY DISEASE

> Severe combined immunodeficiency (SCID) is a rare, genetic disorder, affecting 1 in 60,000 babies
 > It is often called 'bubble boy disease', as the child has to stay in a sterile environment or "bubble"
 > Children with SCID don't have an immune system
 to defend the body from bacteria, viruses, parasites, fungi
 > Child with SCID is treated with a stem cell transplant, also known as bone marrow transplant
 > With new bone marrow, the child's body can build a whole new, functional immune system

- To confirm a SCID diagnosis, a doctor will **evaluate the numbers and types of T and B cells present and their ability to function**.

Wastewater Surveillance for Vector-Borne Diseases

News Excerpt:

There is a debate on the feasibility of using wastewater surveillance to track malaria and dengue in India.

More details on the news:

- Wastewater surveillance has proven effective in certain contexts, but its application to tracking vector-borne diseases in India presents unique challenges.
- The debate revolves around the issue of whether India should also use wastewater surveillance to track vector-borne diseases like developed countries.

Vector-Borne Diseases in India

- Vector-borne diseases (VBDs) have been a public issue

Wastewater surveillance is the process of monitoring wastewater for contaminants. Amongst other uses, it can be used for **bio-surveillance**, to detect the presence of pathogens in local populations, and to detect the presence of psychoactive drugs.

- in India for decades.
- In 2021, the leading cause of death due to vector-borne diseases was **dengue**, with a total of 247 deaths across the country.
- The reasons for the spread of diseases include climate change, lack of sanitation and cleanliness, and stagnant water, which can be a breeding ground for mosquitoes.

Steps taken by the government to control vector-borne disease

- In view of its vector-borne disease burden like malaria, dengue, chikungunya, Japanese encephalitis,

lymphatic filariasis and kala-azar, India has set ambitious goals **to eliminate and eradicate malaria and lymphatic filariasis by 2030.**

- **The National Vector Borne Disease Control Programme (NVBDCP)** is an umbrella programme for preventing and controlling vector-borne diseases.
- The Directorate of **National Vector Borne Disease Control Programme (NVBDCP)** is the central nodal agency for the prevention and control of six vector-borne diseases (VBDs): **Malaria, Dengue, Lymphatic Filariasis, Kala-azar, Japanese Encephalitis and Chikungunya in India.**

Vector-Borne Diseases

- ❖ Vectors act as a medium for transmitting infectious germs from animals to humans and, in some cases, between humans.
- ❖ These organisms first get infected by the disease-causing pathogens, and once infected, they can transmit the pathogen to humans throughout their lives whenever they come in contact with a human host.
- ❖ Diseases transmitted through such vectors are called vector-borne diseases.
- ❖ Some vector-borne disease examples are Malaria, Dengue, Lymphatic Filariasis, Kala-azar, Japanese Encephalitis and Chikungunya.

India receives 'Measles and Rubella Champion' Award

News Excerpt:

Recently, India has been bestowed with the prestigious Measles and Rubella Champion Award by the Measles and Rubella Partnership at the American Red Cross Headquarters in Washington D.C., USA.

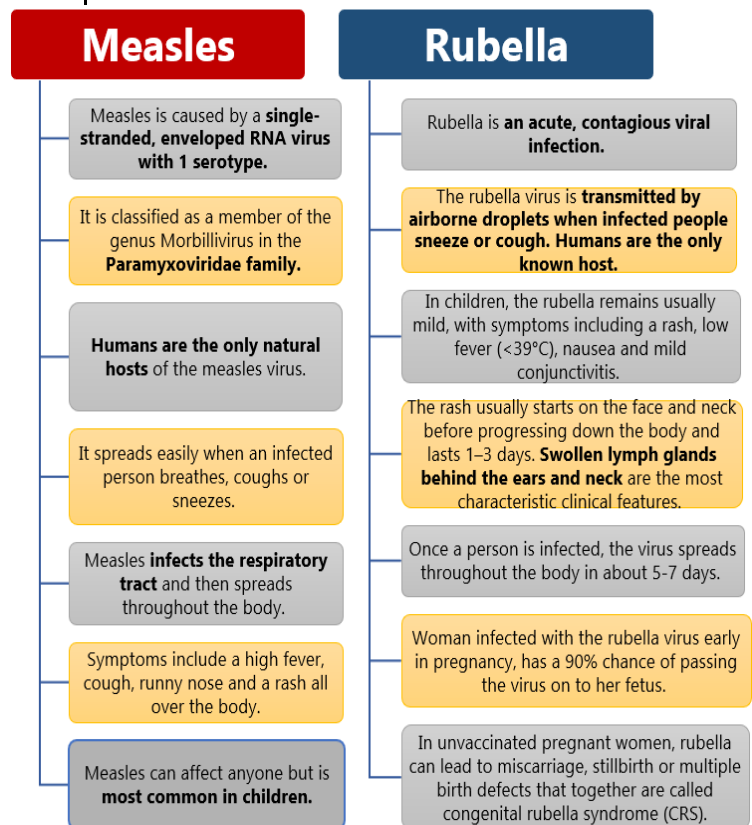
About the Measles and Rubella Partnership:

- The Measles & Rubella Partnership is a **global initiative** to lead and coordinate efforts to achieve a world without measles and rubella.
- **The American Red Cross, the Bill & Melinda Gates Foundation, Gavi the Vaccine Alliance, the United Nations Foundation, the U.S. Centers for Disease Control and Prevention, UNICEF and the World Health Organization** lead the Measles & Rubella Partnership (M&RP).
- The **M&RP** aims to achieve a world without measles and rubella by:
 - **Supporting countries to raise coverage of vaccines;**
 - Fund, plan, implement and monitor **quality supplementary campaigns;**
 - **Investigate outbreaks and provide technical and financial support** to strengthen immunization delivery;

- **Support a global laboratory network** for measles and rubella.
- Since 2001, the Partnership has helped to raise measles vaccination coverage to 83% globally and **reduced measles deaths by 82%.**
- In 2022, the M&RP supported vaccination **campaigns in 44 countries** that reached more than 115 million children with bundled vaccines, operational costs or technical assistance.

Steps taken to prevent the Measles and Rubella (MR) in India:

- Measles and Rubella are vaccine-preventable diseases (VPDs) and the MR Vaccine has been **part of India's UIP since 2017.**
- Measures that have strengthened India's MR elimination strategy:
 - The development and implementation of the **National Strategic Plan for MR elimination;**
 - **Introduction of rubella-containing vaccine** into the routine immunization programme;
 - Launching a **nationwide MR supplementary immunization catch-up campaign;**
 - Transitioning from outbreak-based surveillance to **case-based acute fever and rash surveillance;**
 - **Expansion of the MR Laboratory network** to 27 labs across the country and implementation of the roadmap plan for MR Elimination across the country.



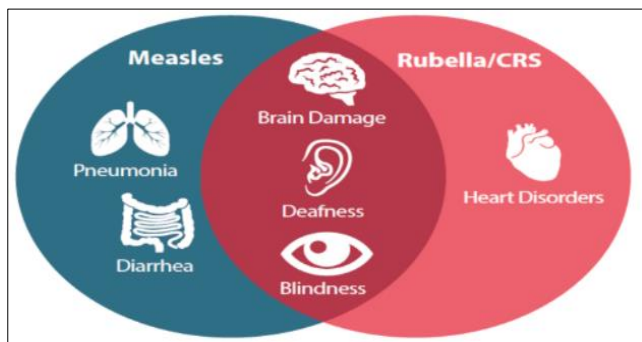
The Measles-Rubella (MR) 2020 program:

- It had the goal to eliminate measles by 2020, but due to the COVID-19 outbreak, it was revised to **2023**.
- The MR campaign targets around **41 crore children** in the age group of 9 months to 15 years (covering 1/3 of the total population of the country) followed by 2 doses in **routine immunization at 9-12 months and 16-24 months**.

Current Status of Measles and Rubella in India:

- **Measles cases dropped by 62% between 2017 and 2021**, from 10.4 to 4 cases per million population, while rubella cases decreased by 48%, from 2.3 to 1.2 cases per million population.
- India is conducting three rounds of Intensified **Mission Indradhanush 5.0 (IMI 5.0)** under the theme “**A big leap towards measles and Rubella Elimination**”, to **identify and vaccinate all unvaccinated** and under-vaccinated children till five years of age, from August 2023.

The overlap of Measles and Rubella:



First human clinical trial of gene therapy for haemophilia A (FVIII deficiency)

News Excerpt:

Union Minister of Science & Technology revealed on **National Science Day (28 Feb)** that India has conducted the **first human clinical trial of gene therapy for**

haemophilia A (FVIII deficiency) at Christian Medical College (CMC) Vellore.

About the Haemophilia Gene Therapy trial:

- The programme is supported by the **Department of Biotechnology**, the Centre for Stem Cell Research - a unit of InStem Bengaluru, in collaboration with Emory University, USA at **Christian Medical College, Vellore**.
- The trials involved deploying a novel technology of **using a lentiviral vector to express an FVIII transgene in the patient's own haematopoietic stem cell** which will then express FVIII from specific differentiated blood cells.

About Haemophilia:

- Haemophilia A, also called factor VIII (8) deficiency or classic haemophilia, is a **genetic disorder** caused by missing or defective factor VIII (FVIII), a clotting protein.
 - Although it is passed down from parents to children, about 1/3 of cases found have no previous family history.
- Haemophilia is passed down from parents to children.
- Haemophilia is a **sex-linked disorder**. The X and Y sex chromosomes help determine haemophilia inheritance patterns.
- **The gene for haemophilia is carried on the X chromosome**. Haemophilia is inherited in an X-linked recessive manner.
 - Females inherit two X chromosomes, one from their mother and one from their father (XX).
 - Males inherit an X chromosome from their mother and a Y chromosome from their father (XY).
 - That means if a son inherits an X chromosome carrying haemophilia from his mother, he will have haemophilia.
 - It also means that **fathers cannot pass haemophilia on to their sons**.

Symptoms of Haemophilia:

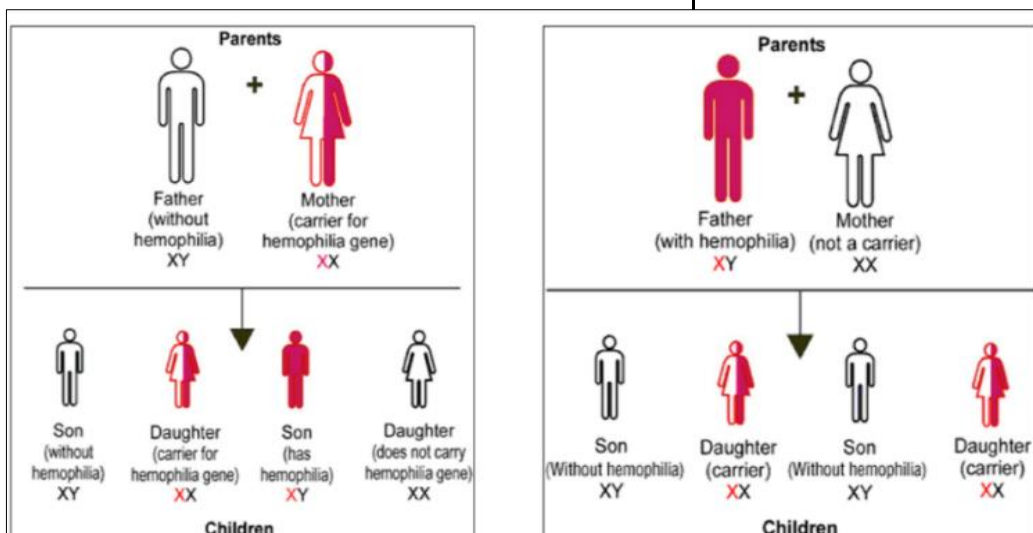
- People with haemophilia A **bleed longer than other people**. Bleeds can occur internally, in joints and muscles, or externally, from minor cuts, dental procedures, or injuries.

• How often a person bleeds and the severity of those bleeds depends on how much FVIII a person produces naturally.

• **Normal levels of FVIII range from 50% to 150%**. Levels below 50% – or half of what is needed to form a clot, determine a person's symptoms.

Treatment for Haemophilia:

- The main medication to treat haemophilia A is a



concentrated FVIII product, called clotting factor or simply factor.

- Many new treatments for haemophilia A are being developed, **from gene therapy to new non-factor replacement therapies.**

India second highest in hepatitis B & C after China

News Excerpt:

According to a WHO's 2024 Global Hepatitis Report report, **India has the second-highest cases of hepatitis B and C after China, with 3.5 crore cases in 2022.**

Hepatitis:

- Hepatitis is an **inflammation of the liver** that is caused by a variety of infectious viruses and non-infectious agents leading to a range of health problems.
- It is the **second-leading infectious cause of deaths globally** — with 1.3 million deaths per year, the same as **tuberculosis, a top spreadable killer.**
- There are **five main strains** of the hepatitis virus, referred to as types **A, B, C, D and E.**
- While they **all cause liver disease**, they **differ in important ways** including **modes of transmission, severity of the illness, geographical distribution and prevention methods.**
- **Hepatitis B and C are responsible for 96% of overall hepatitis mortality.**
- **Hepatitis B and C are transmitted by unsafe injection practices** and through **contaminated syringes and needles, infected blood and blood products, sexual transmission, from infected mother to child.**

Key highlights of the report:

- India was second only to China in the viral hepatitis burden.
- The number of **deaths globally** from viral hepatitis increased from **1.1 million in 2019 to 1.3 million in 2022.**
 - **83% deaths** were caused by **hepatitis B**, and **17% by hepatitis C.**
- **Bangladesh, China, Ethiopia, India, Indonesia, Nigeria, Pakistan, the Philippines, the Russian Federation and Vietnam,** collectively contribute **nearly two-thirds** of the global burden of **hepatitis B and C.**

India's hepatitis challenge:

- In India **98,305 people died** due to **hepatitis B** while **26,206 succumbed to hepatitis C in 2022.**
 - Only **2.4% of those infected** in the country had received **diagnosis coverage.**
- **Chronic hepatitis B** infection, which is **vaccine preventable**, accounts for **40 to 50% of hepatocellular carcinoma (a type of liver cancer)** and **20 to 30% of cirrhosis cases** in India.
- The **hepatitis B vaccination** was first introduced in India in **2002–2003** as part of the Centre's **Universal Immunisation Programme.**
 - The vaccine was then **expanded throughout the nation in 2010.**
 - It is now provided as part of the **pentavalent vaccine** at **6, 10 & 14 weeks** apart from the **birth dose of hepatitis B vaccine.**

HEPATITIS	How it spreads	Prevention	Treatment
A	Feces Contaminated food or water	<ul style="list-style-type: none"> • Vaccine • Practice good hygiene 	<p>No specific medication available</p> <p>Treated through supportive care (rest, adequate nutrition, and fluids) to help relieve symptoms</p>
B	Through contact with the blood or bodily fluids of an infected person	<ul style="list-style-type: none"> • Vaccine • Practice safe sex • Blood screening 	Combination antiviral therapies (with Tenofovir or Tenofovir derivatives plus lamivudine)
C	Blood-to-blood contact	<ul style="list-style-type: none"> • Practice safe sex • Avoid sharing needles, toothbrushes, razors or nail scissors 	Combination therapies with direct acting antivirals (DAAs)
D	Contact with infected blood (only occurs in people already infected with hepatitis B)	<ul style="list-style-type: none"> • Hepatitis B vaccine • Avoid sharing needles, toothbrushes, razors or nail scissors 	Interferon
E	Feces Contaminated food or water	<ul style="list-style-type: none"> • Practice Good Hygiene • Avoid drinking water that has come from a potentially unsafe source • Cook food well 	<p>No specific medication available</p> <p>Supportive Care</p>

WHO Broadens Definition of Airborne Diseases

News Excerpt:

After a drawn-out global controversy over the coronavirus, the WHO has updated its classification of how pathogens spread through the air.

Earlier Terminologies:

- Before the pandemic, the WHO and other agencies typically recognized a few ways diseases could spread.
 - **“contact transmission,”** in which someone picked up a pathogen either by **touching an infected person** directly or **through contact** with a contaminated surface.
 - **“Droplet transmission”** involved the **short-range spread of diseases** when people **coughed or sneezed droplets larger than 5 microns** (five millionths of a metre), which then landed directly on a victim’s **mouth, eyes or nose**.
 - **“Airborne transmission”** referred to just a handful of diseases that spread in **droplets smaller than 5 microns**, floating for long distances until someone inhaled them.
- Varying terminology **“highlighted gaps in common understanding** and contributed to **challenges in public communication** and **efforts to curb transmission”** of Covid-19.

New definition of airborne pathogens and diseases:

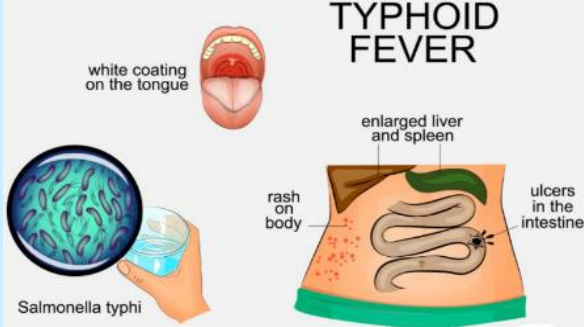

- Under the new terminology, **all particles expelled** from the **mouth** or **nose** of an infected person,

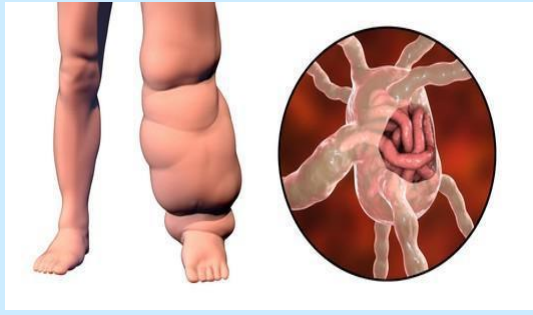
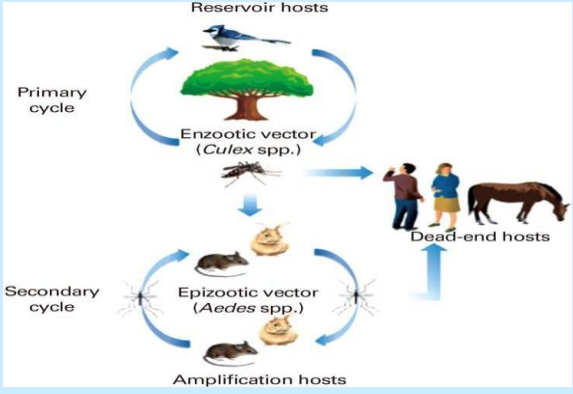
regardless of size, are called **“infectious respiratory particles”** or IRPs.



- According to the WHO, the **spectrum of IRP sizes is continuous**, meaning there is **no strict cut-off between smaller and larger particles**.
- The descriptor **“through the air”** characterises diseases where the main transmission mode involves IRPs travelling through or being suspended in air.
- Within this new definition, **WHO defines two types of transmission**.
 - First, **airborne transmission** or inhalation, when **IRPs are expelled into the air** and inhaled by others at short or long distances, depending on factors like airflow and ventilation.
 - Second, **direct deposition**, when IRPs expelled by an infectious person are **deposited on the exposed mouth, nose or eyes** of a nearby person.

Difference between old and new terminologies:

- Earlier agencies have historically required **high levels of proof** before calling diseases airborne, which required very stringent containment measures; the new definition says the **risk of exposure** and **severity of disease** should also be considered.
- Past disagreements also centred around whether infectious particles were **“droplets”** or **“aerosols”** **based on size**, which the **new definition moves away from**.

DISEASES IN NEWS	
NAME OF DISEASE	DETAILS
<p>Typhoid: News Excerpt:</p>  <p>A phase-3 trial in children aged between nine months and 12 years carried out in Malawi, Africa, which is a typhoid fever-endemic setting, has shown that the efficacy of the Hyderabad-based Bharat Biotech's conjugate typhoid toxoid vaccine - Typbar - lasts for at least four years.</p>	<p>Currently, there are two conjugated typhoid vaccines —</p> <ul style="list-style-type: none"> The Typbar TCV typhoid vaccine manufactured by Bharat Biotech, which received WHO prequalification in 2017, Biological E's Vi-CRM197 conjugated typhoid vaccine received WHO prequalification in 2020. <p>About Typhoid:</p> <ul style="list-style-type: none"> Typhoid fever is a bacterial infection that can spread throughout the body, affecting many organs. It's caused by a bacterium called Salmonella typhi, which is related to the bacteria that cause salmonella food poisoning. Typhoid fever is highly contagious. An infected person can pass the bacteria out of their body in their poo or, less commonly, in their pee. Typhoid fever is most common in parts of the world that have poor sanitation and limited access to clean water. <p>Symptoms of typhoid fever:</p> <ul style="list-style-type: none"> A persistent high temperature that gradually increases each day, Headache, General aches and pains, Extreme tiredness (fatigue), Cough, Constipation
<p>Alaskapox News Excerpt:</p> <p>Alaskapox, a rare virus causing mild illnesses, has been found in Alaska for nine years. Recently, a man died from the virus, bringing attention to it.</p> 	<ul style="list-style-type: none"> Alaskapox belongs to a family of brick-shaped viruses that can infect animals and humans. These bugs, known as orthopoxviruses, tend to cause lesions, or pox, on the skin. Alaskapox was discovered in 2015 by a woman who lived near Fairbanks, Alaska. <ul style="list-style-type: none"> It mainly has been found in small mammals, including red-backed voles and shrews. However, pets like dogs and cats may also carry the virus. <p>Symptoms:</p> <ul style="list-style-type: none"> People with Alaskapox have developed one or more bumps or pustules on the skin, as well as joint or muscle pain and swollen lymph nodes. Nearly all patients had mild illnesses that resolved on their own after a few weeks. However, people with weakened immune systems can be at risk of more severe illnesses. <p>How does it spread?</p> <ul style="list-style-type: none"> Alaskapox spreads through contact with infected animals. There has been no documented case of it spreading from one person to another. However, other viruses in the same family can spread when one person comes in contact with another person's lesions. <p>Prevention from Alaskapox:</p> <ul style="list-style-type: none"> Alaskapox is a rare illness that, in most cases, causes relatively mild symptoms. The best way to keep pets and family members safe is to keep a safe distance and wash your hands after being outdoors. Do not keep wildlife as pets.

<p>Lymphatic Filariasis News Excerpt: The Union Minister of State for Health and Family Welfare recently inaugurated the first phase of the Bi-annual Nationwide Mass Drug Administration (MDA) campaign to eliminate Lymphatic Filariasis.</p> 	<ul style="list-style-type: none"> It is commonly known as elephantiasis and is a neglected tropical disease. Infection occurs when filarial parasites are transmitted to humans through mosquitoes. <ul style="list-style-type: none"> Infection is usually acquired in childhood and causes hidden damage to the lymphatic system. It is caused by infection with parasites classified as nematodes (roundworms) of the family Filariodidea. There are 3 types of these thread-like filarial worms: <ul style="list-style-type: none"> Wuchereria bancrofti, which is responsible for 90% of the cases. Brugia malayi and Brugia timori also cause the disease but to a lesser extent. The painful and profoundly disfiguring visible manifestations of the disease – lymphoedema, elephantiasis and scrotal swelling – occur later in life and can lead to permanent disability. India aims to eliminate Lymphatic Filariasis by 2027, three years ahead of the global target, i.e. 2030, through a mission-driven strategy. <p>About Mass Drug Administration (MDA) campaign:</p> <ul style="list-style-type: none"> It seeks to halt disease transmission by administering free preventive medications to residents in affected areas. It is the WHO-recommended preventive chemotherapy strategy for lymphatic filariasis elimination. The medicines used have a limited effect on adult parasites but effectively reduce the density of microfilariae in the bloodstream and prevent the spread of parasites to mosquitoes.
<p>Western Equine Encephalitis News Excerpt: Recently, the International Health Regulations National Focal Point (IHR NFP) in Argentina alerted the Pan American Health Organization/World Health Organization (PAHO/WHO) of a human case of Western Equine Encephalitis Virus (WEEV) infection.</p> 	<ul style="list-style-type: none"> Western Equine Encephalitis is a mosquito-borne infection caused by the WEEV, which belongs to the genus Alphavirus of the Togaviridae family of viruses. The virus has an approximately 11.5 kilobases long single-stranded RNA genome and is a recombinant of the eastern equine encephalitis virus and a Sindbis-like virus. <p>Symptoms of WEE</p> <ul style="list-style-type: none"> Its symptoms in humans usually manifest 5 to 15 days after infection from a mosquito bite. The usual symptoms include: Fever, Headache, Nausea, Vomiting, Poor appetite, Tiredness, Weakness Passerine birds are thought to be the reservoir, and equine species are considered intermediate hosts. In humans, the WEE virus can cause diseases ranging from subclinical or moderate symptoms to severe forms of aseptic meningitis and encephalitis. Mode of Transmission: The primary transmission mode of the infection to humans is through mosquitoes, which act as vectors for the virus.
<p>Blue Tongue Disease News Excerpt: China has banned the direct and indirect import of ruminants and its related products from Iraq due to an outbreak of bluetongue disease.</p>	<ul style="list-style-type: none"> Bluetongue is a non-contagious, viral disease spread by biting insects. It is not known to affect humans. It causes many different symptoms in affected animals, including ulcers, sores, painful hooves, lameness and reproductive problems. Disease characteristics - Inflammation of the mucous membranes, congestion, swelling and haemorrhages. <ul style="list-style-type: none"> Sheep are generally the worst affected, while cattle and goats do not usually show any clinical signs of disease.

	<ul style="list-style-type: none"> • Bluetongue virus is transmitted by infected Culicoides species (biting midges). • Occurrence - The virus is present in a broad band of countries extending approximately between 40°N and 35°S. <p>Prevention and eradication of Bluetongue: Since there is no curative treatment for Bluetongue virus (BTV)-infected animals, prophylactic immunization of susceptible species remains the most effective and practical control measure against bluetongue in endemic regions.</p>
<p>Mange outbreak News Excerpt: The forest department is monitoring an outbreak of mange among a pack of Asiatic wild dogs in the Mudumalai Tiger Reserve (MTR in the Nilgiris, which they strongly suspect has spread to the animals through the local feral dog population.</p> <ul style="list-style-type: none"> • Three animals from a pack of Asiatic wild dogs (dholes) around Bokkapuram in Mudumalai Tiger Reserve (MTR), a high human-wildlife interface area, are believed to have been affected by mange, a skin disease caused by parasitic mites. 	<ul style="list-style-type: none"> • Mange can be caused by two types of mites: Sarcoptic and demodectic. • Demodectic mites naturally inhabit a dog's skin, but cause infections when the mites overpopulate a dog with a weakened immune system. <ul style="list-style-type: none"> ○ This form of mange is not contagious to other dogs or humans. Most demodectic mange cases happen in puppies under 12 to 18 months of age. • Sarcoptic mange, also referred to as scabies, is contagious to both dogs and humans. • It occurs when a dog comes into contact with the sarcoptes scabiei mite, and it mostly affects stray dogs that aren't on preventative medication.
<p>Zombie deer disease News Excerpt: Zombie deer disease, a chronic wasting disease caused by prions, is spreading across North America, Scandinavia, and South Korea.</p> 	<ul style="list-style-type: none"> • It is a chronic wasting disease that affects deer, elk, reindeer, sika deer, and moose. • It can affect animals of all ages and may take over a year before an infected animal develops symptoms, including drastic weight loss (wasting), stumbling, listlessness and other neurologic symptoms. • There are no treatments or vaccines for the disease. • It can also infect humans and pose a risk to wild populations. <p>Why is it called zombie deer disease?</p> <ul style="list-style-type: none"> • It is a fatal neurological illness affecting deer, elk, moose, and related species. • It's caused by abnormal proteins called prions, which damage the brain and nerve tissues. <p>Symptoms include emaciation, disorientation, lethargy, and abnormal behaviour, earning it the nickname "zombie" due to affected animals exhibiting staggering gaits and vacant expressions.</p>
<p>Bowel Disease News Excerpt: Recently, a Swedish study found that children who had a high intake of fish and vegetables at one year of age were at lower risk of developing Inflammatory Bowel Disease (IBD).</p>	<p>About the diet and its effects on IBD:</p> <ul style="list-style-type: none"> • According to the study done on 80,000 children through adolescence in Norway and Sweden, the diet of infants as young as a year old could affect their chances of developing IBD in future. • At three years of age, no dietary factor other than fish intake was associated with IBD risk. • Infants may benefit from a "preventive" diet that includes adequate dietary fibre, particularly from fruit and vegetables.
<p>Guinea worm disease News Excerpt: South Sudan and Mali, where Guinea worm disease was once more common, have made commendable progress, although the fight continues in Chad and the Central African Republic.</p>	<ul style="list-style-type: none"> • Guinea worm disease, also called dracunculiasis, is caused by Guinea worm (Dracunculus medinensis). • Guinea worm disease, a neglected tropical disease (NTD), the disease affects poor communities in remote parts of Africa that do not have safe water to drink. • There is neither a drug treatment for Guinea worm disease nor a vaccine to prevent it.

	<p>Status of Guinea worm in India:</p> <ul style="list-style-type: none"> • India eliminated Guinea worm disease in the late 1990s. The government of India received Guinea worm disease-free certification status from the WHO in 2000.
<p>Lyme disease News Excerpt:</p> <p>A suspected case of Lyme disease caused by the bite of a tick (Black Legged Tick) carrying borrelia (Borrelia Burgdorferi) bacteria has been reported from Koovapady in Ernakulam district.</p>	<p>Lyme disease is a vector borne infection caused by the bacterium Borrelia burgdorferi and in rare cases, Borrelia mayonii.</p> <ul style="list-style-type: none"> ○ Transmission of disease occurs through the bite of infected blacklegged ticks also known as deer ticks. • Lyme disease was first recognized in the town of Old Lyme, USA, in 1975. • It is the most common vector-borne disease in the United States. 