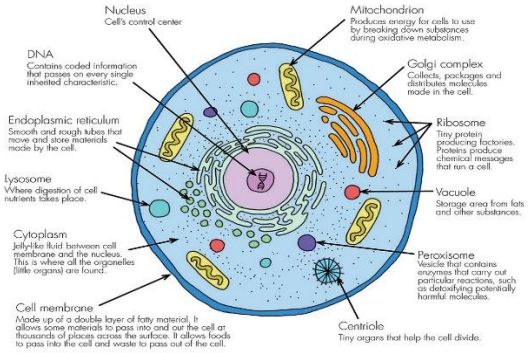
Current Affairs 24rth August 2025 by Right IAS

Evolution of Complex Cells

Core Mystery in Biology Question: How did simple cells (bacteria, archaea) evolve into complex eukaryotic cells (animals, plants, fungi)? Eukaryotic cells = advanced internal structures (organelles, cytoskeleton). Prokaryotic cells = simpler machinery.

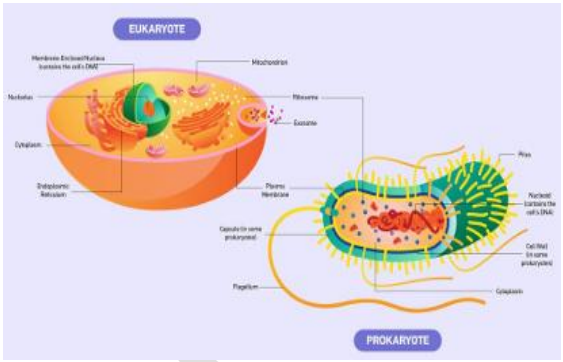


Role of Asgard Archaea A group of archaea called Asgard archaea are the closest living relatives of eukaryotes. Their genes provide important clues about early cellular complexity.

Importance Cytoskeleton = network of proteins → gives cells shape, helps in division, supports internal structure.

In bacteria → FtsZ protein essential for cell division.

Key Discovery (IISc Study, EMBO Journal) Studied Odinarchaeota (member of Asgard group). Found: it carries two versions of the FtsZ gene + a tubulin-like gene. Unusual because most microbes carry only one FtsZ gene. Findings – Two Distinct FtsZ Proteins OdinFtsZ1 Forms straight protofilaments (similar to bacterial FtsZ). Anchors directly to membranes. OdinFtsZ2 Forms spiral ring-like structures. Needs an adaptor protein for membrane attachment. Together → interact and cooperate inside cells.



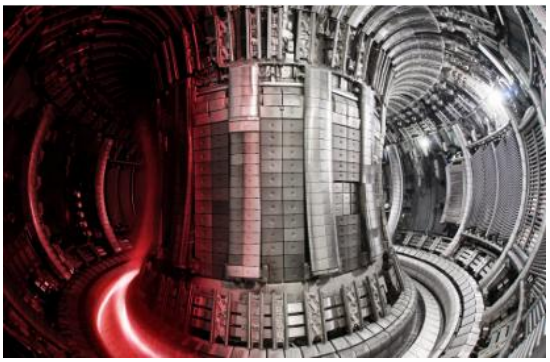
Significance Shows division of labour between proteins → a sign of growing cellular complexity.

In eukaryotes → proteins like tubulin play similar but more advanced roles.

Combination of two FtsZ paralogs + tubulin-like protein suggests: Asgard archaea were experimenting with diverse cytoskeletal systems. Represents a turning point in evolution → foundation for eukaryotic cytoskeleton.

Topic → Ammonia-Powered Solid Oxide Fuel Cells (SOFCs)

Problem: Ammonia (NH_3) is a promising clean fuel alternative to hydrogen. Direct use in solid oxide fuel cells (SOFCs) often leads to inefficiencies and reliability issues.



Recent Innovation: Scientists combined a fuel cell with a plasma reactor. A plasma

reactor is a device that uses concentrated energy to create and control plasma a highly ionized gas for various industrial and scientific applications Plasma reactor breaks ammonia into hydrogen (H_2) and nitrogen (N_2) before it reaches the SOFC. Benefits: Increased power output by 60% at 800°C. Plasma process works at room temperature, ensuring quick operation. Ability to recycle waste heat → improves overall energy efficiency.

Significance:

Provides a practical pathway to use ammonia as clean fuel. Storage advantage: Ammonia is easier and safer to store compared to hydrogen. Contributes to clean energy transition and reduction of fossil fuel dependence.

The Hindu

Topic → Svalbard glacier

Event: In summer 2024, Svalbard (Norwegian Arctic Archipelago) witnessed an unprecedented glacier meltdown. Scale of Melting: Nearly 1% of Svalbard's total ice lost in just six weeks. Comparable to the annual ice loss of Greenland

Cause: Record-high temperatures. Influx of warm, moist air into the Arctic region. Significance: Such extreme melt events were once considered rare. Now projected to become more frequent due to global warming. Implications: Accelerated sea-level rise. Increased risk for coastal communities worldwide. Highlights vulnerability of Arctic ecosystems and global climate stability.

Topic → Can NFTs enhance research on tissue samples?

Problem with Current System: Human tissue samples are widely used in research and biotech companies. Donors are often not informed or involved in how their samples are used. Raises ethical concerns about consent, benefit sharing, and transparency.

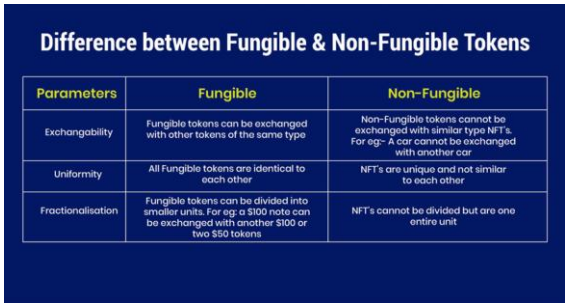
New Proposal: Scientists suggest a "decentralised biobank" model. Based on blockchain technology and non-fungible tokens (NFTs). How It Works: Each donor's specimen is linked to a unique NFT. The NFT serves as a secure digital record.

Tracks ownership, usage, and consent at every step. Benefits: Transparency: Donors can see how their samples are being used. Participation: Encourages more people to donate tissue samples. Research Efficiency: Secure data-sharing could speed up scientific progress.

Trust Building: Addresses ethical issues by giving donors more control. Significance: Represents a new way to balance scientific advancement with individual rights and

ethics. Could reshape the future of biomedical research governance.

A Non-Fungible Token (NFT) is a unique, one-of-a-kind digital asset stored on a blockchain, used to certify ownership and authenticity for digital or physical items like art, music, videos, or collectibles.



Difference between Fungible & Non-Fungible Tokens

Parameters	Fungible	Non-Fungible
Exchangability	Fungible tokens can be exchanged with other tokens of the same type	Non-Fungible tokens cannot be exchanged with similar type NFTs. For eg:- A car cannot be exchanged with another car
Uniformity	All Fungible tokens are identical to each other	NFTs are unique and not similar to each other
Fractionalisation	Fungible tokens can be divided into smaller units. For eg: a $100 note can be exchanged with another $100 or two $50 tokens	NFTs cannot be divided but are one entire unit

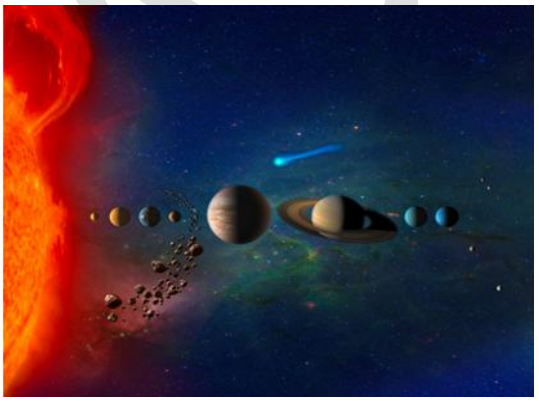
The Hindu

Topic ⟶ How scientists determine the temperature of planets or stars

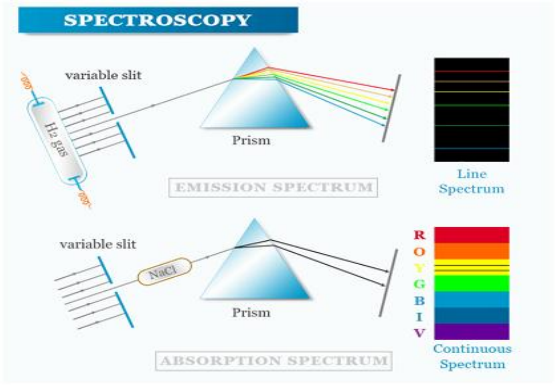
How Scientists Determine Astronomical Temperatures Spectroscopic Method (Core Technique): Temperature is estimated using spectroscopy (analysis of light). Invented in 1859 by Robert Bunsen and Gustav Kirchhoff. When substances are heated to incandescence, they emit characteristic wavelengths of light. Each element has a unique spectral fingerprint (emission or absorption lines).

Application to Astronomy: Light from stars and planets passes through a spectroscope. The spectral lines indicate which elements are present. The intensity and pattern of these lines give clues about the temperature of the emitting body.

Beyond Visible Light: Initially, only visible light was studied. Modern astronomy uses the entire electromagnetic spectrum: Infrared → Useful for cooler bodies like planets. X-rays, Ultraviolet, Radio waves → For studying hotter and high-energy phenomena in stars. Star Classification: Stars are classified based on their spectral type (O, B, A, F, G, K, M) which directly relates to surface temperature. Example: O-type stars are the hottest, M-type are cooler.



Planets: For planets, temperature is estimated by: Infrared radiation emitted. Reflected light spectrum from the host star. Atmospheric absorption features (if present).



The Hindu

Topic ⟶ Tobacco control in India

The Cigarettes and Other Tobacco Products Act (COTPA) 2003. Smokeless Tobacco (SLT) Neglect SLT is the most widely consumed tobacco form in India. Reasons: cheaper, culturally acceptable, less social stigma. SLT is often more carcinogenic than smoked tobacco. Laws like Food Safety and Standards Regulations, 2011 exist but are weakly enforced

Surrogate Advertising Direct tobacco ads are banned, but companies use surrogate methods (mouth fresheners, brand logos, similar packaging). Movies, OTT platforms, social media also promote tobacco indirectly. Surrogate exposure encourages initiation in teens and young adults, weakening control measures. Weak Fiscal Provisions COTPA lacks direct taxation measures.

Taxation = most effective tool, yet: Bidi tax: ~22% Cigarette tax: ~50% WHO recommends 75%. Smokeless tobacco (SLT) poorly taxed (mainly unorganised sector). Since GST (2017), only two small hikes (2020–21 & 2022–23), making tobacco more affordable with rising incomes.

Ineffective Health Warnings India mandates 85% pictorial warnings on packs. Current warnings: focus on oral cancer & early death. Other countries show impacts on fertility, pregnancy, blood circulation. Impact of warnings in India rarely evaluated. Recommendation: Plain packaging to reduce appeal.

E-Cigarettes Banned under Prohibition of Electronic Cigarettes Act, 2019.

Enforcement weak → e-cigarettes still sold online. Emerging public health risk

1. National Tobacco Control Programme (NTCP) Limitations Focuses on awareness & COTPA enforcement. Fails to address social determinants (poverty, unemployment, stress, hunger) that fuel tobacco use. Biomedical cessation clinics are inadequate for millions of users.
2. Weak School Awareness (ToFEI) Tobacco Free Education Institute (ToFEI) → limited to posters & occasional events. Lacks scientific rigor & comprehensive strategy. Compared to U.S. CDC recommendations, ToFEI fails in: Teacher training Family involvement Cessation support for children Program evaluation Lack of Updated Data
3. Tobacco industry uses real-time sales data to adapt marketing. Public health researchers lack recent, updated data. This weakens policy-making & interventions.

Way Forward Stronger law enforcement. Uniform and higher taxation in line with WHO. Target smokeless tobacco aggressively. Introduce plain packaging. Strict e-cigarette ban implementation. Incorporate social determinants in cessation strategies. Evidence-based school

education programmes. Build real-time data systems for tobacco consumption trends. Adopt a multi-pronged, collaborative approach for India's tobacco endgame.

FACT-> Morphogenesis is the biological process that governs how an organism develops its shape and structure. It involves the coordinated actions of cell growth, differentiation, and movement, leading to the formation of tissues, organs, and ultimately, the complete body plan.

Why is the Mercator map under fire?

The African Union (AU) has endorsed the 'Correct the Map' campaign to replace the Mercator map projection with alternatives such as the Equal Earth map. At the heart of this demand is the charge that the Mercator projection, still widely used in schools, media, and online platforms, systematically distorts the sizes of landmasses, shrinking Africa while inflating Europe, North America, and Greenland. By backing the call, the AU has expressed hope that a fairer projection will restore geographical accuracy and correct what it characterises as centuries of symbolic marginalisation. The Mercator projection was designed in 1569 by Flemish cartographer Gerardus Mercator, who was trying to solve a navigation problem. On a globe, a ship sailing in a constant compass direction, called the rhumb line, curves when drawn on most map types.

The Hindu