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Expected EDITORIAL EXPLAINED

for

IAS Mains Examination

05th Oct *To* 10th Oct 2026



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1.1. POLITY & GOVERNANCE

1.1.1. A COURT DIVIDED BY ITS OWN ARCHITECTURE

Introduction

The Supreme Court is envisaged not merely as the highest appellate court but also as the **guardian and final interpreter of the Constitution**. However, its predominantly small-Bench structure and heavy Special Leave

Petition (SLP) workload have created institutional challenges in timely and consistent constitutional adjudication.



Significance of a Strong Constitutional-Court Architecture

1. **Protects constitutional supremacy:** Ensures that legislative and executive actions remain subject to **constitutional scrutiny**, safeguarding the supremacy of the Constitution.
2. **Strengthens rule of law:** Consistent interpretation of constitutional provisions promotes **legal certainty, predictability and equality before law**.
3. **Protects fundamental rights:** Timely constitutional adjudication enables citizens to obtain effective remedies against violations of **Fundamental Rights**.
4. **Ensures institutional accountability:** Judicial review acts as a check on arbitrary exercise of legislative and executive power, reinforcing **separation of powers**.
5. **Strengthens democratic institutions:** Timely resolution of disputes involving institutions such as the **Election Commission, Parliament and federal structures** prevents constitutional uncertainty from becoming a fait accompli.
6. **Improves judicial legitimacy:** Consistent precedents, transparent Bench allocation and timely decisions enhance **public confidence in the judiciary** and strengthen its institutional credibility.

Structural Challenges

1. **Appellate overload:** The Court spends a substantial part of its time dealing with SLPs and ordinary appeals, leaving limited judicial capacity for constitutional questions.
2. **Fragmented Bench structure:** The Court largely functions through two- and three-judge Benches, while major constitutional questions require larger Benches under **Article 145(3)**.
3. **Inconsistent jurisprudence:** Different Benches may interpret earlier judgments differently, creating uncertainty and necessitating repeated references to larger Benches.
4. **Delay in constitutional adjudication:** Cases may remain pending for years before reaching Constitution Benches. The *Anoop Baranwal* litigation, for instance, took several years from institution to final adjudication.

5. Concentration of roster power: As the **Master of the Roster**, the CJI determines Bench composition and case allocation. In a multi-Bench Court, this administrative power can have significant institutional consequences.

Consequences

1. Legal uncertainty

- Divergent interpretations by different Benches can create uncertainty regarding the applicable constitutional position.
- This affects **predictability and consistency of law**.

2. Weakening of stare decisis

- Failure to consistently follow binding precedents can dilute the principle of **judicial discipline** under Article 141.
- It may encourage repeated litigation over issues already substantially settled.

3. Delayed judicial review

- Constitutional challenges may remain pending for years, allowing potentially unconstitutional laws or institutional arrangements to continue operating.
- This can reduce the **practical effectiveness of judicial review**.

4. Creation of a fait accompli

- In matters involving elections or constitutional institutions, prolonged litigation can allow appointments, elections or policies to become entrenched before their legality is finally determined.

5. Fragmentation of judicial authority

- Multiple Benches speaking differently on similar constitutional questions can make the Supreme Court appear less institutionally coherent.
- This may affect **public confidence and judicial legitimacy**.

6. Impact on democratic governance

- Delayed resolution of disputes concerning bodies such as the **Election Commission** can create prolonged uncertainty in institutions central to democratic functioning.
- Timely constitutional adjudication is therefore essential to preserve **institutional stability and constitutional accountability**.

Global Best Practices — Constitutional & Supreme Court Architecture

1. United States – Dedicated constitutional adjudication

- The **U.S. Supreme Court** exercises strong control over its docket through the **writ of certiorari**.
- This allows it to prioritise cases involving significant constitutional and federal questions rather than routine appeals.

- **Takeaway for India:** Stronger filtering of SLPs can enable the Supreme Court to focus on constitutional questions.

2. Germany – Specialised constitutional court

- The **Federal Constitutional Court** is institutionally distinct from the ordinary appellate judiciary.
- It focuses specifically on constitutional review, fundamental rights and federal disputes.
- **Takeaway:** A dedicated constitutional adjudication mechanism can reduce the conflict between appellate workload and constitutional responsibilities.

3. South Africa – Constitutional Court

- South Africa has a separate **Constitutional Court** as the apex forum for constitutional matters, while ordinary appellate matters are handled through the Supreme Court of Appeal.
- **Takeaway:** Functional separation can improve specialisation and timely constitutional adjudication.

4. France – Constitutional Council

- The **Constitutional Council** exercises constitutional review, including scrutiny of legislation before promulgation and, under the *QPC* mechanism, certain constitutional challenges after legislation comes into force.
- **Takeaway:** Mechanisms for **timely constitutional review** can prevent unconstitutional provisions from becoming entrenched.

5. United Kingdom – Supreme Court with specialised constitutional role

- The UK Supreme Court operates as the final appellate court, while constitutional questions receive structured judicial consideration within a court with a comparatively focused docket.
- **Takeaway:** Clear jurisdictional boundaries and docket management can help an apex court balance ordinary appeals with constitutional questions.

Way Forward

1. **Permanent Constitution Bench:** Establish a dedicated Bench for pure questions of constitutional law, as also suggested by the **Law Commission's 229th Report (2009)**.
2. **Rationalise SLP jurisdiction:** Greater filtering of routine appeals would enable the Court to concentrate on questions of constitutional and national importance.
3. **Clear referral rules:** Develop objective criteria for determining when cases require reference to larger Benches under Article 145(3).
4. **Strengthen precedent discipline:** Smaller Benches should consistently follow binding constitutional precedents under **Article 141**, referring genuine conflicts to larger Benches.
5. **Transparent roster system:** Bench allocation should follow predictable and publicly known institutional principles to strengthen confidence in judicial administration.

Conclusion

The Supreme Court needs to balance its dual identity as an **appellate court and constitutional court**. Separating routine appellate adjudication from constitutional questions through a permanent Constitution Bench, rationalised jurisdiction and clearer Bench-allocation rules can ensure that **constitutional justice is not merely authoritative, but also timely and consistent**.

Q. *The Supreme Court is increasingly functioning as an appellate court rather than as a constitutional court. In this context, examine how its multi-Bench structure, appellate workload and delays in Constitution Bench adjudication affect the consistency and effectiveness of constitutional justice in India. 15 marks (GS 2, Polity)*

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2.1. SCIENCE & TECHNOLOGY

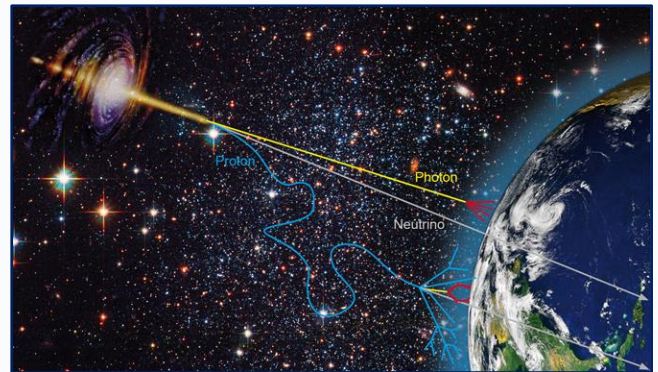
2.1.1. FROM ANTARCTIC ICE TO INDIAN HILLS: THE DAWN OF NEUTRINO ASTRONOMY

Context

The 2026 Nobel Prize in Physics was awarded to Francis Halzen for developing the IceCube Neutrino Observatory, successfully detecting high-energy cosmic neutrinos and opening a new frontier in astrophysics.

Introduction

For centuries, humanity observed the cosmos using the electromagnetic spectrum. Neutrino astronomy shifts this paradigm by using elusive **subatomic particles to trace the universe's most violent and obscured cosmic events, unhindered by interstellar dust or magnetic fields.**



What Are Neutrinos?

- Neutrinos are fundamental, electrically neutral subatomic particles belonging to the lepton family. They interact incredibly weakly with matter, allowing billions of them to pass through planets and human bodies unhindered every second.

Three Types (Flavors) of Neutrinos

- **Electron Neutrino:** Primarily produced during massive nuclear fusion reactions within stellar cores, like the Sun.
- **Muon Neutrino:** Created when high-energy cosmic rays collide with atomic nuclei in the Earth's upper atmosphere.
- **Tau Neutrino:** The rarest flavor, associated with heavy tau leptons in extreme high-energy environments.

What is the Ice Cube Neutrino Observatory?

- **Definition:** A massive, gigaton-scale scientific instrument located at the Amundsen-Scott South Pole Station.
- **Scale:** It transforms a full cubic kilometre of deep Antarctic glacial ice into the world's largest natural particle detector.

Why is Ice Used to Detect Neutrinos?

- **Extreme Clarity:** Deep Antarctic ice is exceptionally pure, bubble-free, and pitch-black.
- **Stable Medium:** It acts as an undisturbed natural matrix to capture faint light signals, completely shielded from surface background radiation.



How Does Ice Cube Work?

- **Particle Interaction:** When a high-energy neutrino rarely collides with an atomic nucleus in the ice, it generates secondary charged particles.
- **Light Detection:** These charged particles emit faint flashes of blue light (Cherenkov radiation), which are captured by over 5,160 embedded optical sensors to reconstruct the neutrino's origin.

India's Contribution to Neutrino Physics

- **Historical Legacy:** India pioneered atmospheric neutrino detection, recording the world's first interaction in 1965 at the Kolar Gold Fields.
- **The INO Project:** The proposed India-based Neutrino Observatory (INO) in Tamil Nadu aims to use a 50,000-tonne Magnetized Iron Calorimeter (ICAL) to uniquely distinguish between neutrinos and anti-neutrinos.

Significance of the Nobel-Winning Discovery

1. **Multi-Messenger Astronomy:** Establishes an independent method to observe cosmic bodies hidden by dense interstellar dust.
2. **Tracing Cosmic Accelerators:** Pinpoints the elusive origin points of ultra-high-energy cosmic rays in distant galaxies.
3. **Probing Extreme Environments:** Captures real-time dynamics inside exploding stars and black holes without signal degradation.
4. **Advancing Particle Physics:** Provides empirical data on neutrino mass hierarchy and behaviors beyond the Standard Model.
5. **Innovative Infrastructure:** Proves that massive natural geological features can serve as high-precision, cost-effective scientific labs.

Challenges Plaguing Mega-Science Projects

1. **Ecological and Wildlife Conflicts:** Domestic projects like INO face severe delays due to proximity to eco-sensitive zones and tiger corridors.
2. **Public Misinformation:** Local communities often mistakenly associate non-radioactive neutrino observatories with nuclear threats, halting progress.
3. **Low Interaction Rates:** Neutrinos so rarely interact with matter that capturing them requires impossibly large and expensive gigaton-scale detectors.
4. **Hostile Operational Environments:** Installing sensitive electronics deep in polar ice or excavating solid rock involves extreme engineering and logistical risks.
5. **Sustaining Mega-Budgets:** These projects require decades of continuous funding, making them vulnerable to shifting political and fiscal priorities.

Way Forward

1. **Proactive Science Communication:** Launch transparent, vernacular campaigns to demystify neutrino science and address public radiation fears.

2. **Eco-Friendly Engineering:** Adopt zero-impact green tunneling and safe muck disposal to secure swift environmental clearances for INO.
3. **Dedicated Funding Streams:** Utilize platforms like the Anusandhan National Research Foundation (ANRF) to ring-fence sustained mega-science budgets.
4. **Deepening Global Ties:** Keep Indian physicists embedded in international projects like IceCube to retain access to cutting-edge data and global expertise.
5. **Indigenous Manufacturing:** Leverage the Make in India initiative to locally produce high-purity sensors, photomultiplier tubes, and magnetized steel.
6. **Building Academic Talent:** Integrate experimental particle physics into university curricula to train a new generation of scientists for future labs.

Conclusion

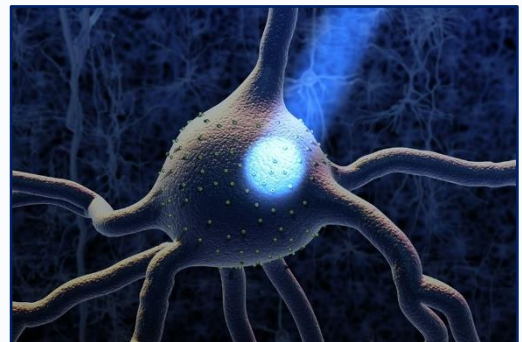
The 2026 Physics Nobel underscores that bold investments in fundamental physics yield transformative scientific leaps. For India, reviving the stalled India-based Neutrino Observatory is imperative not only to reclaim its historical leadership in experimental physics but also to prevent academic brain drain and secure a sovereign role in the next generation of cosmic exploration.

***Q.** Analyse the significance of the Ice Cube Neutrino Observatory in advancing multi-messenger astronomy. Examine the persistent challenges and future prospects of the India-based Neutrino Observatory (INO) in this context. 15 Marks*

2.1.2. OPTOGENETICS AND THE DAWN OF PRECISION NEUROBIOLOGY

Context

The **2026 Nobel Prize in Physiology or Medicine** was jointly awarded to **Karl Deisseroth, Peter Hegemann, and Georg Nagel** for discovering light-gated ion channels and developing **optogenetics** to control neural circuits using light.



Introduction

Conventional neuromodulation methods like pharmacological drugs or electrical stimulation lack cellular specificity. **Optogenetics** integrates **genetics and optics** to selectively switch specific neurons on or off with **millisecond temporal precision**, revolutionizing functional brain mapping.

What is Optogenetics?

1. **Definition:** A biological technique combining genetic engineering and optical technology to control the electrical activity of **genetically targeted cells** using specific wavelengths of light.
2. **Light-Gated Ion Channels:** Employs light-sensitive microbial proteins called **opsins** that embed into cell membranes to act as biological ion conduits.
3. **Optical Mechanism:** Delivering pulses of light (commonly blue light) opens or closes membrane channels, altering the **membrane potential** and firing precise action potentials.

Genesis and Scientific Evolution

1. **The Algal Foundation:** **Peter Hegemann** studied the phototaxis of the green microalga *Chlamydomonas reinhardtii*, identifying how light triggers cellular electrical currents.
2. **Identification of Channelrhodopsins:** Hegemann and **Georg Nagel** characterized **Channelrhodopsin-1 (ChR1)** and **Channelrhodopsin-2 (ChR2)** as direct light-sensitive ion channels.
3. **Translational Leap to Mammalian Brains:** **Karl Deisseroth** successfully transferred ChR2 genes into mammalian neurons using **harmless viral vectors**, establishing targeted optical control in living mammalian brain tissue.

Significance Of the Breakthrough

1. **Causal Neural Circuit Mapping:** Replaces observational imaging with direct, **causal verification** of how specific neural circuits govern memory, emotion, and behavior.
2. **Neuropsychiatric Therapeutics:** Lays the molecular foundation for targeted interventions in **Parkinson's disease, Alzheimer's disease, schizophrenia**, and clinical depression.
3. **Sensory Restoration:** Translational clinical trials have utilized retinal opsin delivery to restore partial functional vision in blind patients.
4. **Elimination of Off-Target Toxicity:** Delivers high cellular precision, overcoming the systemic adverse effects common to traditional **neuropharmacological drugs**.
5. **Interdisciplinary Scientific Convergence:** Integrates botanical microbiology, **molecular genetics**, photonics, and clinical neurology into a unified therapeutic platform.

Key Challenges in Clinical Translation

1. **Invasive Delivery Systems:** Directing light into deep brain structures requires the surgical implantation of **invasive optical hardware**, posing infection and tissue damage risks.
2. **Viral Vector Immunogenicity:** Using **Adeno-Associated Viruses (AAVs)** to introduce foreign algal opsins risks triggering unintended host immune and inflammatory responses.
3. **Neural Network Complexity:** Human brain circuits feature extreme functional redundancy across billions of neurons, making pinpoint therapeutic targeting far harder than in animal models.
4. **Bioethical and Dual-Use Concerns:** The ability to manipulate neural circuitry and behavioral states raises pressing ethical issues regarding **cognitive liberty** and mental privacy.
5. **Healthcare Inequity:** High upfront development and personalized gene therapy costs risk creating severe **access disparities** between developed and developing economies.

Way Forward

1. **Develop Non-Invasive Photonics:** Invest in **red-shifted opsins** and upconverting nanoparticles capable of penetrating cranial bone via near-infrared light without invasive surgery.
2. **Refine Biosafety of Viral Delivery:** Engineer high-affinity, **tissue-specific viral vectors** with minimal immunogenicity to ensure durable and safe clinical gene expression.
3. **Formulate Robust Ethical Guidelines:** Multilateral regulatory bodies must draft clear protocols protecting **patient cognitive sovereignty** and preventing dual-use misuse.

4. **Bridge the Translational Gap:** Establish dedicated **public-private clinical consortia** to fund and de-risk human clinical trials for optogenetic neurotherapeutics.
5. **Ensure Equitable Global Access:** Foster open-access technology-sharing pipelines to ensure life-saving neurotechnologies remain affordable for developing nations.
6. **Integrate Computational Neuroscience:** Combine optogenetic switches with **AI-guided real-time neural decoding** for dynamic, closed-loop neuromodulation.

Conclusion

Optogenetics fundamentally transforms light into a biological tool to decipher the brain's complex circuitry. Realizing its transformative potential will require safe non-invasive delivery, strong bioethical safeguards, and equitable global access to advanced neurotechnologies.

Q. Evaluate the significance of optogenetics in advancing neuroscience and therapeutics. What key challenges hinder its clinical translation into human healthcare? 15 Marks

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