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• NOBEL MEDICINE PRIZE 2026

How scientists used light to control brain cells

The work laid the foundation for optogenetics, which has expanded knowledge of how the brain functions, and could help develop new therapies



ANONNA DUTT

THE NOBEL Prize in Physiology and Medicine for 2026 was jointly awarded to Karl Deisseroth, Peter Hegemann and Georg Nagel for their discovery of an alga protein that reacts to light and its use as a switch to study the functions of nerve cells.

Their explorations led to the creation of a new field of study called optogenetics, which may finally help scientists understand how the brain forms memories, feelings and behaviours.

"We were able to precisely pace the heart and look at the effects that different heart rates have on brain states... Communication across the body, from the body to the brain, but with the precision of a gain of function in a peripheral organ allowing us to see the effects on brain and behavioural state... this ability to execute a precision intervention in one organ and read out the effects in complex behaviours — this is something that people have wanted for a long time to be able to do," said Deisseroth.

In simple terms, they found a way to control cells with light. Imagine that the brain is a vast electrical network containing billions of tiny cells called neurons. These neurons communicate by sending electrical signals, allowing us to move, see, remember, feel pain and experience emotions. Deisseroth, Hegemann and Nagel helped scientists develop a remarkable way of controlling these electrical signals: using light.

Their research led to the discovery and development of light-sensitive proteins, called opsins, that can be placed in specific cells. When light is directed at those cells, the proteins act like tiny switches, turning the cells' activity on or off. This is known as optogenetics — essentially, using light to control genetically modified cells.

• 'For their discoveries concerning light-gated ion channels and optogenetics'



"Optogenetics... fundamentally altered our understanding of the brain," the press release said. It credited the three for ushering in a new era in neuroscience.

ON TUESDAY: NOBEL PRIZE IN PHYSICS



KARL DEISSEROTH, 54
The Howard Hughes Medical Institute and Stanford University



PETER HEGEMANN, 71
Humboldt University of Berlin, Germany



GEORG NAGEL, 73
University of Würzburg, Germany

What is optogenetics?

It is a field of research that uses light to manipulate the activity of neurons or other types of cells and study the resulting effects. This is done by expressing the light-sensitive protein in the targeted cells. Within the brain, it has contributed towards identifying neural circuits responsible for sensing pain, social behaviours, thirst, food consumption, reward and attention or the understanding of how memories are created.

Interestingly, the field rests on a theory proposed by Francis Crick, the molecular biologist who was behind the discovery of the double helix structure of DNA, and was awarded the Nobel prize for it.

He envisioned activating individual nerve cells in the brain to investigate the mechanisms that underlie human consciousness. With nerve signals being extremely rapid, he realised it would only be possible if scientists were somehow able to manipulate the nerve cells with light. He himself admitted that the idea sounded far-fetched.

But it was made possible by the work of Hegemann and Nagel on the alga *Chlamydomonas*. These are famous for their ability to quickly swim towards a light source. Hegemann found that these reacted extremely quickly, within half a millisecond after the light reached a tiny orange dot (called the eyespot) that the alga used to de-

Why the field matters

'Optogenetics has given us an extremely powerful way to switch on and off the neurons and see what happens.'

It has allowed us to manipulate nerve cells and study its effects with an unprecedented level of precision,' said Vidita Vaidya, senior professor, Tata Institute of Fundamental Research.

tect light. For reference, it takes 10 milliseconds for the human eye to react to light. Hegemann wondered, how could the response to light be more than 20 times faster in *Chlamydomonas*?

He hypothesised that a single protein complex both captured light and acted on it in the alga as opposed to the multi-step process in the human eye. Yet, finding this protein was a challenge because when the proteins in the algal eyespot were removed from their natural setting, they became unstable and easily damaged. This is when he discovered that Japanese researchers had mapped the DNA of *Chlamydomonas*, among which were the codes for two genes that shared similarities with light-capturing proteins.

Enter Nagel. He used egg cells of frogs to express the two proteins and confirm Hegemann's hypothesis. The alga detected and reacted to light using the protein channelrhodopsin-2 (ChR-2). They then introduced the cells in different types of cells and found that they all became light sensitive.

Deisseroth found that ChR-2 could control the activity of specific nerve cells in the manner proposed by Francis Crick. He used it to control rat nerve cells in a petri dish and later in the rats. With Deisseroth's lab at the forefront, researchers soon found more proteins that can turn nerve cells on and off, and which are activated by different wavelengths of light.

How does it help to study the brain?

"Imagine the brain to be a building with lots and lots of rooms — now there was no way for us to know what happens if the light is switched on in just one room. Optogenetics has given us an extremely powerful way to switch on and off the neurons and see what happens. It has allowed us to manipulate nerve cells and study its effects with an unprecedented level of precision. It has completely changed the scale at which discoveries are happening in neurosciences," said Vidita Vaidya, senior professor at the Tata Institute of Fundamental Research.

Optogenetics is still largely used in laboratories to see which set of neurons regulates what type of behaviour in animals, helping scientists look into the black box, Vaidya says. Dr Sanjeev Kumar Mahto, professor at IIT BHU, said it has allowed scientists to see the functions of the brain and enhance the understanding of what causes certain conditions.

Deisseroth's research group introduced the gene for ChR-2 in 2006 and successfully used light to activate neurons and control the movements of mouse whiskers. The same year, he used the technique to wake sleeping mice by manipulating a recently discovered type of nerve cell that was suspected to control wakefulness. His team also studied the brains of mice as they experienced fear, and noted which nerve cells appeared to form memory. When they later reactivated these nerve cells, the mice showed signs of fear, despite not being in danger at the time.

What kind of therapies are being developed based on this field?

There are ongoing clinical trials on restoring vision in people who have become blind due to *retinitis pigmentosa*, a disease that destroys the eye's rods and cones. Using special glasses emitting light, the person was able to discern and grasp objects on a table. There are also hopes that optogenetics could improve cochlear implants. Currently, these implants stimulate the auditory nerve using electricity.

• 'X', born in the UK, was conferred the Nobel Prize in 2025. He was a professor in an American university when this prize was announced. Identify 'X' :

- (a) Michel H. Devoret
- (b) Richard Robson
- (c) John Clarke
- (d) Joel Mokyr

1. Nobel Prize in Physiology or Medicine 2026: Optogenetics

Source: The Hindu

GS: GS-3 — Science & Technology | Biotechnology | Neuroscience

Context: Karl Deisseroth (USA), Peter Hegemann (Germany) and Georg Nagel (Germany) received the 2026 Nobel Prize in Physiology or Medicine for discoveries that enabled scientists to control nerve-cell activity using light.

1. What Was the Nobel-Winning Discovery?

1. **Hegemann** studied the green alga *Chlamydomonas* and investigated how it detects light.
2. **Hegemann and Nagel** identified and characterised **channelrhodopsins**, light-sensitive proteins found in microorganisms.

3. **Channelrhodopsin-2 (ChR2)** acts as a **light-gated ion channel**: light causes it to open and allows ions to pass through the cell membrane.
4. **Deisseroth** demonstrated that these proteins could be introduced into neurons, making their electrical activity controllable with light.

2. What Are Light-Gated Ion Channels?

1. **Ion channels** are membrane proteins that regulate the movement of electrically charged ions across cells.
2. **Light-gated ion channels** are channels whose opening is triggered by light.
3. When introduced into a neuron, they can change the neuron's electrical state and therefore control whether it becomes active.
4. They effectively work as **biological switches controlled by light**.

3. What Is Optogenetics?

Optogenetics = Genetic modification + Light

1. A specific gene coding for a light-sensitive protein is introduced into selected neurons.
2. The neurons produce the light-sensitive protein.
3. Light is then delivered to those neurons to control their activity.
4. This allows scientists to manipulate **specific neural circuits with very high precision**, rather than affecting large areas of the brain.

4. Why Is It a Major Scientific Breakthrough?

1. **Brain mapping**: Helps identify which neural circuits control movement, memory, pain, reward and behaviour.
2. **Cause-and-effect**: Scientists can activate or inhibit a particular circuit and directly observe its effect on behaviour.
3. **Speed**: Light can control neurons on a **millisecond timescale**, matching the rapid functioning of the nervous system.
4. **Disease research**: Provides a powerful tool for studying abnormal neural circuits involved in neurological and psychiatric disorders.

5. Medical Potential

1. **Retinitis pigmentosa**: Optogenetic approaches are being investigated to restore light sensitivity in certain forms of inherited retinal degeneration.
2. **Neurological disorders**: The technique helps identify and understand dysfunctional neural circuits.
3. **Targeted treatment**: It could eventually enable highly specific manipulation of diseased neural circuits.

4. **Limitation:** Most therapeutic applications remain experimental because safe gene delivery, precise light delivery and long-term safety need to be established.

• LEGAL

House privileges vs free speech: The question before Supreme Court

Amaal Sheikh
New Delhi, October 5

THE SUPREME Court on Tuesday will begin hearing a long-pending reference on the scope of legislative privileges, special powers and immunities enjoyed by Parliament and state legislatures to protect their functioning, and whether they can be invoked against citizens, journalists and others for breaching the privileges of the House.

A seven-judge Constitutional Bench comprising the Chief Justice of India Surya Kant will hear the matter.

At the heart of the case is whether these privileges, under Articles 105 and 194 of the Constitution, can override fundamental rights such as freedom of speech and expression under Article 19.

Legal framework

Article 194(3) grants legislatures certain privileges and immunities. Article 19(1)(a) guarantees freedom of speech and expression, including press freedom. The case turns on the interplay between these two rights and whether legislative privilege can override the right to free speech. The petitioners contend that such a privilege exists to protect the House's functioning, not to shield it from scrutiny.

Articles 14 and 21 provide for the right to equality and the right to life. The petitioners argue that when legislatures order arrests or imprisonment for alleged breaches of privilege, they affect personal liberty. According to them, any action affecting liberty must satisfy constitutional guarantees of fairness, due process and protection against arbitrariness.

History of the challenge

In 2003, *The Hindu* reported on sharp exchanges between Tamil Nadu Chief Minister J. Jayalithaa and the Opposition in the state Assembly. Speaker K. Kalimuthu objected to those reports and referred them to a Privileges Committee, saying the descriptions were "contrary to truth" and "had affected the privileges of the legislature".

The controversy escalated after *The Hindu* published an editorial criticising the "crude use of state power against various sections including political opponents and the independent media". It stated that legislative privilege "exists to protect its free and independent functioning and not to protect the reputation of the government or of individual members". A Tamil translation published by *Murasoli* was also referred to the Committee.

The Assembly ultimately held five journalists of *The Hindu* and *Murasoli* editor S.

Past verdicts

● In 1954, the SC ordered the release of the editor of *Blitz*, who had been detained under the UP Assembly Speaker's warrant, after finding that he had not been produced before the magistrate within 24 hours.

● In *Sita Soren* (2024), it held that bribery is not protected by the Constitution. It overruled a 1998 ruling wherein the court had granted immunity to MPs accused of taking bribes to vote.

Selvam guilty of gross contempt and breach of privilege, sentencing them to 15 days imprisonment and issuing arrest warrants. The journalists approached the SC, which immediately intervened and stayed the warrants but referred the matter to a Constitution Bench.

Supreme Court precedents

The reference came about because of two conflicting Constitution Bench decisions. In 1959, the SC, in a 4:1 majority, in *Pandit M.S.M. Sharma v. Sri Krishna Sinha* (also known as the Searchlight case) held that Assembly privileges under Article 194(3) included the power to prohibit publication. It said that because Article 19(1)(a) is a general provision and Article 194(3) is a special provision, free speech must yield to legislative privilege.

But in the Special Reference No. 1 of 1964, the Uttar Pradesh Assembly jailed a citizen, Keshav Singh, distributing pamphlets accusing an MLA of corruption. When the Allahabad High Court granted him interim bail, the Assembly ordered that the two judges who passed the order, the lawyer and Keshav Singh himself be brought before the House in custody. While a Full Bench of the HC stayed those arrest warrants, the President referred the dispute to the SC.

The SC bench held that Constitutional

courts could examine the legality of detention ordered in privilege proceedings, and that legislatures could not proceed against judges and lawyers for performing their duties. The court said that the Searchlight case did not lay down a universal rule that fundamental rights in Part III of the Constitution (Articles 12-35) always yield to legislative privileges.

What petitioners are arguing

The petitioners argue that the TN Assembly's action violated free speech, personal liberty, and basic principles of natural justice. They contend that "honest and courageous reporting by the press is the bedrock of parliamentary democracy" and that journalists cannot perform their role "in an atmosphere of fear and terror".

They argue that legislative privileges are subject to Article 21 and that permitting a legislature to deprive a person of liberty "by mere passing of a resolution" would be "an anathema to the Constitution". The petitioners also argue that privileges exist to protect the functioning of the House, not the government, stating that there is "no concept of any parliamentary privilege being applicable to a Chief Minister... or to a 'government'" and that privileges are "not intended to protect the fame and reputation of the ruling party".

2. House Privileges vs Free Speech: Supreme Court Examines the Constitutional Balance

Source: The Hindu

GS: GS-2 — Indian Polity & Constitution | Parliament | Fundamental Rights | Judiciary

Context: A seven-judge Constitution Bench of the Supreme Court is examining whether legislative privileges can override fundamental rights when Parliament or State Legislatures take action against citizens, journalists or legislators for an alleged breach of privilege.

1. Constitutional Framework

1. **Article 105:** Privileges and immunities of Parliament and its members.
2. **Article 194:** Corresponding privileges and immunities of State Legislatures and their members.
3. **Article 19(1)(a):** Guarantees freedom of speech and expression, including press freedom.
4. **Article 21:** Protects life and personal liberty and requires fairness in State action.

5. **Core issue:** Whether legislative privilege can restrict fundamental rights when its exercise results in detention, punishment or other coercive action.

2. Why Is the Issue Important?

1. **Purpose of privilege:** Legislative privileges exist to ensure the **independent and effective functioning of the House**, not to protect individual members from legitimate criticism.
2. **Press freedom:** Journalists may face privilege proceedings for reports or publications considered to affect the dignity or functioning of the legislature.
3. **Personal liberty:** Privilege proceedings can, in certain circumstances, result in detention or imprisonment, directly affecting Article 21.
4. **Constitutional balance:** The case involves balancing **legislative autonomy with freedom of speech, personal liberty and due process**.

3. Important Supreme Court Precedents

1. **M.S.M. Sharma v. Sri Krishna Sinha (1959):** The *Searchlight* case recognised the power of the legislature to exercise privilege in relation to publication of proceedings.
2. **Special Reference No. 1 of 1964:** The *Keshav Singh* case examined the conflict between legislative privilege and judicial authority, establishing that legislative privilege is not completely beyond constitutional scrutiny.
3. **P.V. Narasimha Rao v. State (1998):** The Court had recognised limited immunity for legislators in relation to parliamentary speech or votes.
4. **Sita Soren v. Union of India (2024):** The Supreme Court overruled the earlier position on bribery immunity and held that legislators cannot claim constitutional immunity from prosecution for bribery connected with their legislative functions.

4. What Are the Petitioners Arguing?

1. **Free speech:** Honest and courageous reporting is essential for parliamentary democracy.
2. **Article 21 protection:** Any detention or imprisonment through privilege proceedings affects personal liberty and must satisfy constitutional standards.
3. **Natural justice:** A person facing coercive privilege action should have procedural safeguards and a meaningful opportunity to defend themselves.
4. **Limited scope:** Privilege should protect the **functioning of the legislature**, not the reputation of a government or individual political leader.
5. **Judicial review:** Courts should be able to examine whether privilege has been exercised constitutionally and for a legitimate legislative purpose.

5. Core Constitutional Question

1. **Legislative privilege:** Protects the dignity, autonomy and effective functioning of the legislature.
2. **Fundamental rights:** Protect speech, liberty, equality and procedural fairness.
3. **The balance:** Legislative privilege cannot automatically become superior to every fundamental right merely because the legislature invokes it.
4. **Judicial role:** The Supreme Court may clarify the extent to which courts can review privilege-based action affecting individual rights.

India, Switzerland to strengthen ties in defence, nuclear energy sectors

Shubhajit Roy
New Delhi, October 5

INDIA AND SWITZERLAND signed pacts on mobility that will ease granting longer-duration visas and the exchange of young professionals and agreed to strengthen cooperation in defence and nuclear energy sectors, as Prime Minister Narendra Modi met Swiss President Guy Parmelin on Monday.

After the bilateral meeting with the visiting Swiss President, PM Modi said, "Today, we identified new possibilities for cooperation in military exchanges and defence production. We also reached a consensus on further deepening our collaboration in the field of nuclear energy."

On people-to-people ties, he said that the Migration and Mobility Partnership Agreement and the Young Professionals Agreement signed today will open up numerous new opportunities in Switzerland for Indian students, researchers, professionals, and the youth.

According to Ministry of External Affairs, the MoU aims to develop migration and mobility cooperation under equal treatment principles, and to prevent and combat irregular migration/human exploitation/trafficking in accordance with national laws. "It provides for multiple-entry visas for up to 5 years, including stays of up to 6 months on each visit, and renewable 1-year student per-



Switzerland President Guy Parmelin with Prime Minister Narendra Modi at the Hyderabad House in New Delhi on Monday. PRAVEEN KHANNA

mits," it said. On the agreement for exchange of young professionals, MEA said that the pact incorporates an exchange of 300 persons annually per country, which may increase to 500, and a timeline of 30 to 90 days for verification of nationality/residency status, among other provisions.

Lauding Swiss President Parmelin, Modi said, "I appreciate his commitment to India-Switzerland relations. Last October, with his personal support, we operationalised a historic Trade and Economic Partnership Agreement between India and the European Free Trade Association (EFTA) countries. This is India's first FTA with any economic bloc in Europe."

"It is also an ambitious blueprint for investment, innova-

tion, jobs, and shared prosperity. Through this, we aim to realise the goals of attracting \$100 billion in investment and creating one million direct jobs in India over the next 15 years."

Swiss President Parmelin said, "Trade was a key aspect, as my visit marks the first anniversary of the entry into force of the Trade and Economic Partnership Agreement between India and the European Free Trade Association. This partnership benefits both sides: India gains access to capital, technology transfers, and easier access to markets for high-value-added goods. Switzerland, for its part, benefits from trade with a massive partner experiencing sustained growth—at a time when global trade has become more vulnerable and unpredictable."

He said, "I am accompanied by a large delegation of high-ranking business leaders, underscoring our commitment to capitalising on the opportunities offered by this trade and economic partnership agreement."

"To further boost investment, Switzerland hopes to conclude an investment protection agreement soon. In this context, achieving results in discussions on intellectual property protection is equally important," the Swiss President said.

In October last year, the Trade and Economic Partnership Agreement (TEPA) between India and the European Free Trade Association (EFTA) States of Iceland, Liechtenstein, Norway and Switzerland, came into force. Modi said, "We have taken several important deci-

sions to expand market access for Indian exports to Switzerland and further facilitate investment between the two countries."

"This will increase India's exports of agriculture, pharmaceuticals, textiles, and engineering goods to Switzerland. At the same time, we will attract new Swiss investment in key sectors like biotech, life sciences, banking, insurance, food processing, and sustainability," he said.

Through these initiatives, we will jointly develop trusted supply chains and reliable solutions for the entire world, he added. Modi said, "The ropeway in Varanasi, the Jewar Airport in Noida, and railways and tunnelling projects in hilly areas are shining examples of our infrastructure cooperation."

An agreement was also inked for collaboration on transport and infrastructure. "We invite Swiss infrastructure companies to invest in India on a large scale, and to participate in capacity building, design, and manufacturing," Modi said.

The PM said new joint research projects in priority areas such as health, clean energy, and space will be launched soon.

He said India-EFTA Prosperity Summit on Wednesday will be an important platform to translate the promise of our trade and investment partnership into concrete outcomes, he said. PM Modi also extended his best wishes to Switzerland for hosting the next edition of the AI Summit next year.



Consider the following statements :

Statement-I :

Switzerland is one of the leading exporters of gold in terms of value.

Statement-II :

Switzerland has the second largest gold reserves in the world.

Which one of the following is correct in respect of the above statements?

- (a) Both Statement-I and Statement-II are correct and Statement-II is the correct explanation for Statement-I
- (b) Both Statement-I and Statement-II are correct and Statement-II is not the correct explanation for Statement-I
- (c) Statement-I is correct but Statement-II is incorrect
- (d) Statement-I is incorrect but Statement-II is correct

3. India–Switzerland Relations: Expanding from Economic Ties to Strategic Partnership

Source: The Hindu

GS: GS-2 — International Relations | GS-3 — Trade, Investment, Defence, Nuclear Energy & Technology

Context: Swiss President **Guy Parmelin's 2026 visit to India** has strengthened bilateral cooperation in **trade, investment, defence, nuclear energy, technology, infrastructure and human mobility**, indicating a shift from a predominantly economic relationship towards a broader strategic partnership.

1. India–Switzerland: Foundation of the Relationship

1. **Diplomatic relations:** India and Switzerland established formal relations through the **Treaty of Friendship, 1948**.
2. **Common ground:** Both support **democracy, rule of law, multilateralism and peaceful resolution of disputes**, although their foreign-policy traditions differ: India follows strategic autonomy, while Switzerland maintains neutrality.
3. **Traditional cooperation:** The relationship has developed around **trade, investment, science and technology, education, research, pharmaceuticals, finance and infrastructure**.
4. **Strategic relevance:** Switzerland provides India access to **European capital, advanced technology and specialised industrial expertise**, while India offers Switzerland a large and growing market.

2. Economic Relationship: Trade + Investment

1. **Bilateral trade:** India–Switzerland trade was about **US\$23.3 billion in FY 2024–25**, with Switzerland recording a significant trade surplus.
2. **India's exports:** Pharmaceuticals, chemicals, textiles, agricultural products, engineering goods, electrical equipment, precious stones and jewellery.
3. **India's imports:** Gold and precious metals, pharmaceuticals, chemicals, machinery, precision instruments and Swiss watches.
4. **Swiss investment:** Swiss companies have invested substantially in India, particularly in **pharmaceuticals, biotechnology, precision engineering, finance, food processing and clean technology**.
5. **Economic complementarity:** India provides **market size, manufacturing capacity and skilled manpower**, while Switzerland contributes **capital, technology, precision manufacturing and research capabilities**.

3. Trade and Economic Partnership Agreement

1. **TEPA:** The **Trade and Economic Partnership Agreement** was signed between India and the **European Free Trade Association (EFTA)**, comprising **Switzerland, Norway, Iceland and Liechtenstein**.
2. **Implementation:** Signed in **March 2024** and entered into force on **1 October 2025**.
3. **Market access:** EFTA countries offered concessions on **92.2% of tariff lines**, covering **99.6% of India's exports**.
4. **Investment commitment:** EFTA countries committed to an ambition of **US\$100 billion investment in India over 15 years**, linked to the creation of **1 million direct jobs**.
5. **Indian interests protected:** Sensitive sectors such as **dairy, soya and coal** were protected, while opportunities were created for Indian **pharmaceuticals, textiles, engineering goods, processed food and agricultural products**.

4. New Areas of Cooperation in 2026

1. **Defence:** India and Switzerland are exploring greater **defence-industrial cooperation, military exchanges, training and joint production/development**, supporting India's defence-indigenisation objective.
2. **Nuclear energy:** Cooperation is being strengthened in **civil nuclear energy**, relevant to India's long-term clean-energy and energy-security requirements.
3. **Technology:** Cooperation is expanding into **Artificial Intelligence, health technology, clean energy and space**, linking Swiss research capabilities with India's growing technology ecosystem.
4. **Infrastructure:** Swiss expertise in **precision engineering, tunnelling, transport and urban infrastructure** can support India's large infrastructure programme.
5. **Investment ecosystem:** Discussions on **investment protection and intellectual-property protection** aim to create greater certainty for businesses and encourage technology-intensive investment.

5. Mobility, Skills and Human Capital

1. **Migration and Mobility Partnership:** Facilitates legal mobility while addressing **irregular migration, trafficking and readmission**.
2. **Young Professionals:** A dedicated agreement provides opportunities for young professionals to gain **work and professional experience** in the other country.
3. **Talent mobility:** Easier movement of professionals, researchers, students and entrepreneurs can strengthen **knowledge transfer and innovation**.
4. **Strategic value:** Human mobility complements trade and investment by creating **people-to-people and institutional linkages**, rather than limiting the relationship to commercial transactions.

6. Significance for India

1. **Technology transfer:** Swiss expertise can support India in **precision engineering, pharmaceuticals, advanced manufacturing, AI and clean technologies.**
2. **Investment and employment:** TEPA's investment ambition can strengthen manufacturing and generate employment through new production facilities and supply chains.
3. **European market access:** Switzerland and the wider EFTA framework provide Indian businesses with improved access to **high-value European markets.**
4. **Energy security:** Nuclear and clean-energy cooperation can contribute to India's objective of expanding **reliable low-carbon energy.**
5. **Strategic diversification:** Defence, technology and nuclear cooperation reduce dependence on purely commercial ties and deepen India's engagement with technologically advanced European partners.

From India to Global South, a Gujarat water-governance model



PARAMESWARAN IYER, NITIN BASSI AND DANIEL W SMITH

NEW DELHI recently hosted the ninth edition of the India International Water Week under the theme of climate-resilient water management. The talk focused as much on what India has achieved in the last decade as on what comes next — keeping water supply sustainable, using water more efficiently, and treating used water as both an environmental and economic resource.

India's influence in the global water sector has grown substantially. From a country exposed to frequent climate shocks and access challenges to one now preparing for climate extremes such as floods and droughts, it offers lessons for other countries in the Global South. Over the past decade or so, India has designed and implemented some of the world's largest programmes to improve water governance, rejuvenate rivers, increase access to water and sanitation, and enable community-driven water conservation, protection, and augmentation. And if we pause and take a step back in time, it is important to acknowledge the leadership of then Gujarat Chief Minister Narendra Modi's initiatives between 2001 and 2014, a period that served as a laboratory for the water governance reforms that rolled out across India after 2014. These included the design and implementation of the Swachh Bharat

Mission, Jal Jeevan Mission (JJM), Jal Shakti Abhiyan, Namami Gange, Atal Bhujal Yojana (ABY), Per Drop More Crop (PDMC), etc.

This 25-year journey is documented in our new case study, 'From Gujarat to India: Water Lessons for the World', which traces water governance reforms in Gujarat and India from 2001 to 2026. Drawing on official data, policy and programme records, the literature and consultations with practitioners, the study examines how political leadership and prioritisation, public financing, institutional reform, administrative implementation and community engagement came together to strengthen water security at scale. Its central finding is that water security is as much a challenge of governance and institutions as it is of engineering — and that the Gujarat experience offers a useful lens for understanding the subsequent national journey and its relevance to the Global South.

The case study distils four key lessons which, if studied and contextualised appropriately, can prove effective in the coming years and inform water governance in other countries in the Global South: Lead with governance, manage the resource and the service together, root action in communities, and build for scale from the start.

Lead with governance, not only hardware: Political will and institutional strengthening, rather than infrastructure alone, are core to water security. India has developed a framework for putting them into action at scale, called the "4 Ps", which were articulated by PM Modi and UN Secretary-General António Guterres through the Delhi Declaration in October 2018. The first is political leadership that prioritises water, reflected in initiatives such as universal tap water access, a cleaner Ganga, community-driven groundwater management,

and communication campaigns that keep water top of the mind, such as Jal Shakti Abhiyan: Catch the Rain. Second, enabling public (and private) financing for the capital and recurring costs of water governance. Third, developing partnerships between national, state, and local governments; community-based organisations, and national and international knowledge organisations, including multilateral development banks like the World Bank. Fourth, ensuring people's participation in local water decision-making and management, such as communities resolving to make their villages open-defecation free or preparing village-level water security plans. The "4 Ps" are worth emulating in any other context or geography.

Manage the water resource and the service together: Taps and canals will fail if water does not flow. Addressing both water resources development and service sustainability simultaneously and at scale is paramount. Many cities in Africa are growing at a rapid rate, and industrial and irrigation demand will follow, so planning resources and services together now is cheaper than retrofitting later. As India's experience in recent decades shows, getting ahead of the coming surge in water demand with linked water resources and services plans would help countries gain from these economic shifts with lower risk for water insecurity. A key part of getting ahead of this surge is being forward-thinking on water reuse, especially for non-potable uses, including planned data centres and semiconductor fabrication units.

In India alone, the annual market revenue from the sale of treated used water is projected to reach around Rs 73,000 crore by 2047, at current prices.

Root water action in community ownership: Water access gains mo-

mentum in communities equipped with effective local water governance institutions such as India's Pani Samitis, infrastructure that consistently delivers a high-quality service, and a balance of internal resources and external support. This has been demonstrated through numerous water conservation, harvesting, and recharge programmes. There is a governance linkage across scales to achieve this. As demonstrated in Gujarat during 2001-2014, the Chintan Shivirs helped prioritise water governance among key stakeholders and formulate actionable solutions to design water-related policies aligned with community expectations. A similar approach was replicated at the national level. The recent Departmental Summit on Water organised by the Ministry of Jal Shakti and addressed by the PM in September 2026 is an example.

Going big and scaling up: The world is off track on SDG 6 to ensure safe drinking water and sanitation for all, and to sustainably manage water resources, used water, and ecosystems by 2030. Estimates suggest an additional \$500 billion in annual investment is required. To meet the scale of water governance reforms, infrastructure installation, data collection, and maintenance required for SDG 6, governments and their leaders cannot afford to slow down. Implementation of JJM across the country demonstrates that India can both think big and implement big. The global community can learn from political leadership at the highest level in India about the will, the financing and the institutions to do it at scale.

Iyer is a former secretary to the Government of India at the Ministry of Jal Shakti; Bassi is a fellow with the Council on Energy, Environment and Water; Smith is an assistant professor at George Mason University. Views are personal

Water access gains momentum in communities equipped with effective local water governance institutions such as India's Pani Samitis

7. “दक्षिणी एशिया में जल संसाधन, सम्पत्ति और विवाद का स्रोत दोनों हैं।” उदाहरण देते हुए इस कथन का परीक्षण कीजिए।
(उत्तर 150 शब्दों में दीजिए)

“Water resources are both an asset and a source of conflict in South Asia.” Examine this statement giving examples.
(Answer in 150 words) 10

- Q. 16 भारत अलवणजल (फ्रेश वाटर) संसाधनों से सुसंपन्न है। समालोचनापूर्वक परीक्षण कीजिये कि क्या कारण है कि भारत इसके बावजूद जलाभाव से ग्रसित है।

India is well endowed with fresh water resources. Critically examine why it still suffers from water scarcity. 12½

20. भारत के सूखा-प्रवण एवं अर्द्धशुष्क प्रदेशों में लघु जलसंभर विकास परियोजनाएँ किस प्रकार जल संरक्षण में सहायक हैं?

In what way micro-watershed development projects help in water conservation in drought-prone and semi-arid regions of India? 12½

4. Gujarat's Water-Governance Model: From Scarcity to a Global Model

Source: The Indian Express

GS: GS-2 — Governance, Local Government | GS-3 — Water Resources, Environment, Climate Change

Context: At the **9th India International Water Week**, held in New Delhi on **climate-resilient water management**, India's water-governance journey was discussed through a new case study, “**From Gujarat to India: Water Lessons for the World.**” The case study traces reforms from **Gujarat (2001–14) to national programmes and their relevance for the Global South.**

1. Water Challenges Faced by Gujarat

1. **Water scarcity:** Large parts of Gujarat, particularly **Saurashtra, Kutch and North Gujarat**, face arid/semi-arid conditions and irregular rainfall.
2. **Groundwater stress:** Heavy dependence on groundwater contributed to declining water tables and, in coastal areas, **salinity intrusion.**
3. **Drought vulnerability:** Recurring droughts created problems for **drinking water, agriculture and rural livelihoods.**
4. **Regional imbalance:** Water availability was unevenly distributed, creating a gap between **water availability and demand.**

5. **Governance gap:** The challenge was not only lack of water infrastructure but also the need for **institutions capable of managing water sustainably**.

2. Gujarat's Response: How the Model Emerged

1. **Infrastructure:** Expansion of reservoirs, canals, pipelines, check dams and groundwater-recharge structures.
2. **Narmada network:** Large-scale water-transfer infrastructure helped supply water to water-deficit regions.
3. **WASMO: Water and Sanitation Management Organisation**, established in 2002, promoted decentralised and community-managed rural water supply.
4. **Pani Samitis:** Village-level institutions involved communities in **planning, implementation, operation and maintenance**.
5. **Integrated governance:** Water supply was combined with **conservation, recharge, local planning and community participation**.

3. Why Gujarat Became a Model

1. **Governance + infrastructure:** Demonstrated that water security cannot depend on physical infrastructure alone.
2. **4 Ps: Political leadership, public financing, partnerships and people's participation** became the central governance principles.
3. **Community ownership:** Local institutions made beneficiaries active participants in managing water systems.
4. **Scalability:** Gujarat's experience provided lessons that could subsequently be incorporated into national programmes.
5. **Core lesson: Manage the water resource and the water service together;** a tap or canal is sustainable only when the underlying water source is secure.

4. From Gujarat to India and the Global South

1. **National scaling:** Lessons from Gujarat were reflected in programmes such as **Jal Jeevan Mission, Jal Shakti Abhiyan, Namami Gange, Atal Bhujal Yojana and Per Drop More Crop**.
2. **Scale:** Jal Jeevan Mission demonstrates India's ability to take water governance from **local/community-level initiatives to nationwide implementation**.
3. **Global relevance:** Countries in the Global South face similar pressures from **water scarcity, climate extremes, urbanisation and rising demand**.
4. **International lesson:** India can share **governance principles, community institutions, financing approaches and technology**, rather than exporting a rigid scheme.
5. **SDG 6:** The experience is relevant to **Sustainable Development Goal 6**, particularly universal access to safe water and sustainable water-resource management.



File Photo : Chief Minister, Bihar

**अब शिकायत लेकर दफ्तरों के
चक्कर नहीं, ट्विटर (X) पर
@BiharCMQRT को टैग करते ही
हरकत में आएगी टीम;
24 घंटे काम करेगा CM ऑफिस
का क्विक रिस्पॉन्स सिस्टम**

5. Bihar's New Social-Media-Based Grievance Response System

Context: Bihar already has the **Sahyog Real-Time Monitoring System (RTMS)** for formal grievance registration and monitoring. The new initiative adds a **Quick Response mechanism through X**, allowing citizens to tag **@BiharCMQRT** for faster attention to complaints.

1. Existing System: Sahyog RTMS

1. **Sahyog RTMS:** Bihar's centralised digital platform for registering and monitoring public grievances.
2. **Basic function:** Citizens register a complaint online and receive a **unique grievance number** to track it.
3. **Administrative workflow:** Complaints are forwarded to the concerned department or authority for disposal.
4. **Monitoring:** The system provides **status tracking, reminders and escalation** for pending complaints.
5. **Objective:** Ensure **time-bound, transparent and accountable grievance redressal** rather than leaving complaints to conventional administrative channels.

2. What Is the New Addition?

1. **X-based access:** Citizens can tag **@BiharCMQRT** on X to bring a grievance directly to the attention of the Chief Minister's Office.
2. **Quick Response Team:** A dedicated team is intended to examine such tagged complaints and initiate administrative action.
3. **24-hour response mechanism:** The initiative envisages a **Quick Response System functioning around the clock**, as highlighted in the announcement.
4. **Different from RTMS:** RTMS is the **formal grievance-registration and monitoring platform**; the X mechanism provides an additional **rapid-access channel**.
5. **Purpose:** The new layer is intended particularly to ensure that issues receiving immediate public attention are **noticed and acted upon quickly**.

3. Why Is It Significant?

1. **Faster access:** Citizens can directly bring urgent issues to administrative attention through a widely used digital platform.
2. **Responsive governance:** It reduces the distance between **citizen complaint and administrative response**.
3. **Accountability:** Publicly visible complaints can create greater pressure for timely administrative action.
4. **Digital-era governance:** It represents a shift from merely **digitising grievance registration to using real-time digital communication for responsive administration**.

5. **Citizen-centric administration:** The approach strengthens the principles of **accessibility, responsiveness, transparency and accountability** in governance.

Pneumonia death at plague institute in Siberia raises alarm

The Associated Press

Russian authorities have quarantined a hospital and are monitoring contacts of an employee at a plague research institute in Siberia who contracted pneumonia of an “unknown” cause. Local state TV said the woman died last week.

Russian authorities said they found no evidence that her illness was caused by any of the pathogens she worked with. But the case has raised alarm in Russia after unconfirmed media reports suggested

she might have died of pneumonic plague – a less common but severe form of plague that can spread from person to person.

The woman worked at the Irkutsk Anti-Plague Research Institute of Siberia in the Far East in Irkutsk, southeastern Siberia.

Irkutsk Gov. Igor Kobzev said called it a suspected case of “a particularly dangerous infection.”

U.S. Secretary of State Marco Rubio said on Monday he did not think there is cause for alarm, but the U.S. was closely watching.

6. Suspected Pneumonic Plague Case in Siberia Raises Biosecurity Concerns

Source: Associated Press

GS: GS-3 — Science & Technology | Public Health | Biosecurity

Context: A worker at Russia's **Irkutsk Anti-Plague Research Institute** died from pneumonia of unknown cause, prompting quarantine and contact monitoring. Unconfirmed reports raised concern about **pneumonic plague**, a severe *Yersinia pestis* infection of the lungs that can spread between people through respiratory particles. The case remains **unconfirmed**, but it highlights concerns over laboratory safety and infectious-disease containment.

1. Pneumonic Plague: Key Facts

1. Caused by the bacterium **Yersinia pestis**.
2. Affects the **lungs** and can cause severe pneumonia.
3. Can spread **person-to-person through respiratory particles**.
4. Can become rapidly fatal without early treatment.
5. **Antibiotics are effective** when treatment begins promptly.

2. Why Has It Raised Concern?

1. **Human-to-human transmission** makes pneumonic plague potentially more transmissible than other forms of plague.
2. The suspected case involves a worker at a **specialised anti-plague research facility**, raising laboratory-biosafety concerns.
3. **Quarantine and contact monitoring** help prevent possible secondary transmission.
4. The incident highlights the need for **strict laboratory containment and disease surveillance**.
5. Since plague is **not confirmed**, distinguishing verified evidence from speculation is essential for responsible public-health communication.

• GLOBAL

Behind France's snowballing student protests

Yashee

New Delhi, October 5

AROUND 500 schools stayed shut across France on Monday amid raging protests by high school students.

The protesters have blockaded schools, set fire to waste bins, and in some cases smashed furniture. According to French officials, damage across 40-odd schools is worth around €3 million (Rs 32.5 crore). The protests began on September 17 at the Saint-Exupéry high school in Créteil, a Paris suburb, and quickly spread.

Education Minister Édouard Geffray has announced a feedback programme for students, along with an action plan to quickly hire more teachers beginning Monday.

What do the protesting students want?

The major grievances are overcrowded classrooms, fewer teachers, no nurses or social workers in some schools, and crumbling infrastructure. Inequality is also a factor, with students from poorer suburbs saying their address is impacting their education.

A French government report from April says, "During the 2024-2025 school year, 9.8% of teaching hours were not provided in public secondary schools, of



7. Student Protests in France: Education Grievances and Democratic Participation

Source: The Hindu

GS: GS-2 — Governance, Democracy, Education, Rights | GS-1 — Society

Context: France's recent student protests began over teacher shortages, overcrowded classrooms and inadequate school facilities, but have evolved into a wider debate on how democratic governments respond to young citizens' grievances. The protests therefore provide a useful case study of the relationship between **student mobilisation and democracy**.

1. Why Students Protest

1. **Immediate grievances:** shortage of teachers, overcrowded classrooms, inadequate infrastructure and stressful school schedules.
2. **Institutional concern:** students feel that existing channels are not adequately addressing problems affecting their education.
3. **Generational dimension:** education directly affects employment, social mobility and future opportunities.
4. **Collective mobilisation:** a local grievance can rapidly become a nationwide movement when students organise collectively.
5. **Digital amplification:** social media enables grievances to spread quickly and connect students across locations.

2. How Student Protests Strengthen Democracy

1. **Political participation:** protest allows young people, including those below voting age, to participate in public affairs.
2. **Government accountability:** protests compel governments to explain policies and respond to failures in public services.
3. **Voice to marginalised concerns:** students can bring issues that receive limited attention through conventional political institutions.
4. **Policy correction:** sustained mobilisation can push governments towards reforms, negotiations or institutional review.
5. **Democratic socialisation:** participation in peaceful movements can develop political awareness, civic responsibility and understanding of constitutional rights.