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By saurabh Pandey



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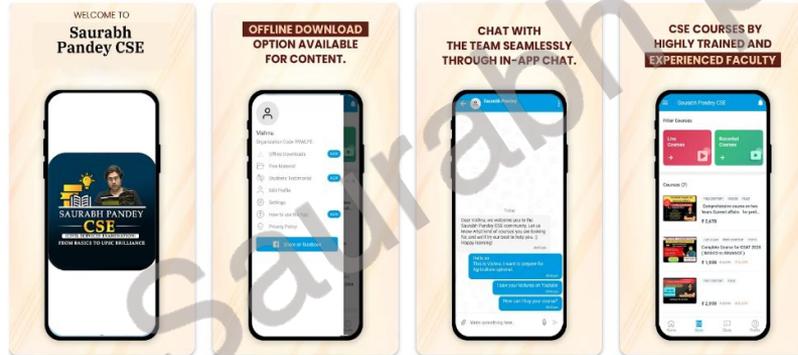
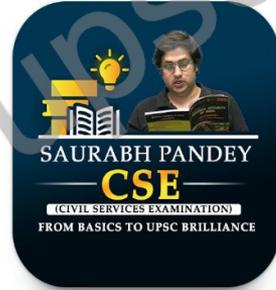
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# Hurdles in importing diamonds pose a quantum block to research ambition

**Jacob Koshy**

NEW DELHI

The Customs Department's decision on who can and cannot import diamonds is taking some of the lustre off the National Quantum Mission (NQM), a ₹6,000-crore initiative, which may help India take the lead in the emerging field of quantum technologies.

Quantum technology is a broad term applicable to multiple avenues of research. It hinges on being able to exploit the “quantum-mechanical” properties of matter inside the atom and develop entirely new kinds of computers, sensors and encryption systems that, proponents say, will make our existing devices primitive in comparison.

However, this also means that much knowledge on harnessing quantum technology is still be-



Unlike gemologists, quantum researchers focus on the ‘defects’ of the diamonds.

ing unearthed and requires trained scientists conducting intricate experiments on many things, including diamonds.

While gemologists may be concerned with the cut, clarity, colour and carats of diamonds, quantum researchers are interested in their “defects”. It is the unique arrangement of carbon atoms in a diamond which gives it the properties of hardness, electrical conductivity and manipu-

lation of light. However, the atomic structure of some diamonds sometimes have two missing carbon atoms. They are substituted by a nitrogen atom as well as a “hole” or what is called a “nitrogen-vacancy” centre.

These “centres” are sensitive to the slightest variations in magnetic fields and thereby open vistas of investigation. An electron at such a centre can be individually tweaked and made to behave like a qubit. Qubits – analogous to the bits and bytes of classical computers – are the logic states of quantum computers and in theory allow calculations, beyond the capacity of existing supercomputers, to be done in a trice.

Researchers can also use lasers at room temperatures to manipulate these centres. However, unlike the diamonds in jewellery shops, scientists prefer their diamonds grown in a

lab, customised with the ‘defects’ of their choice.

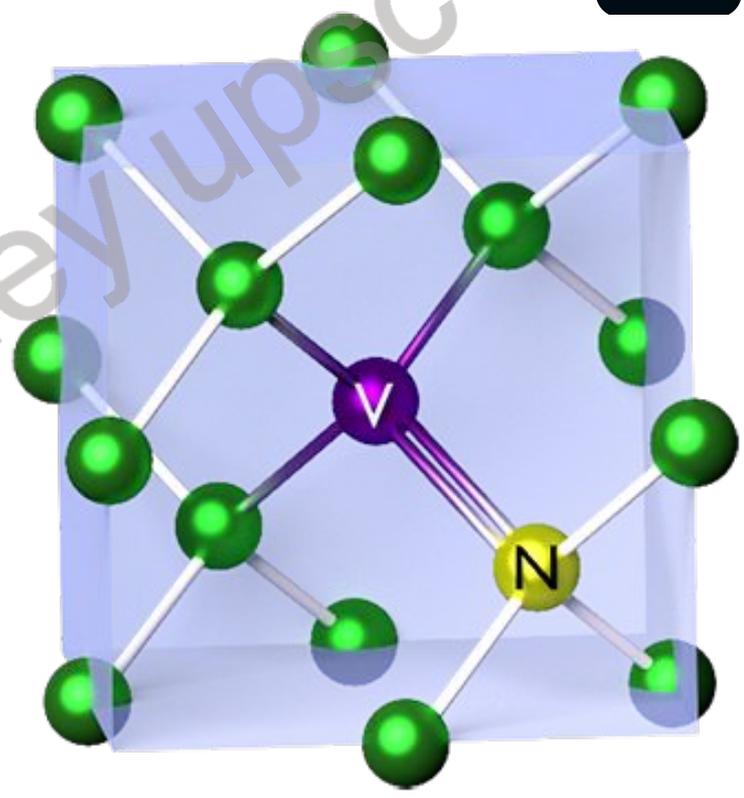
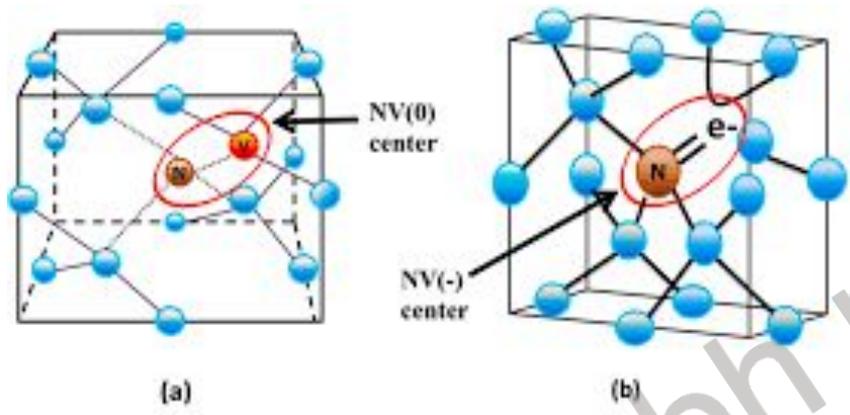
In the Union Budget 2023, Finance Minister Nirmala Sitharaman announced a scheme to promote research and development of lab-grown diamonds. India, despite being a formidable industry in cutting and polishing diamonds, has only just begun manufacturing them. Indian diamondaires are not yet equipped to make diamonds with quantum-research-ready “defects”. And this is a problem for scientists.

The Science and Technology Ministry has announced plans to make quantum computers of 50 to 1,000 qubits by the decade-end. But, quantum computers globally are far from being useful devices because maintaining electrons – like in the ‘defect diamonds’ – in their qubit like states is a daunting challenge.



# “nitrogen vacancy” centre.

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Saurabh Pandey upsc



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## Budget 2020 announced Rs 8,000 crore over the next 5-yrs in the National Mission on Quantum technology and its applications



- The areas of focus for the NM-QTA Mission will be in fundamental science, translation, technology development and towards addressing issues concerning national priorities
- The mission can help prepare next generation skilled manpower, boost translational research and also encourage entrepreneurship and start-up ecosystem development.
- Quantum principles will be used for engineering solutions to extremely complex problems in computing, communications, sensing, chemistry, cryptography, imaging and mechanics



- Their applications which will be boosted include those in aero-space engineering, numerical weather predictions, simulations, securing the communications & financial transactions, cyber security, advanced manufacturing, health, agriculture, education
- It can bring India in the list of few countries with an edge in this emerging field will have a greater advantage in garnering multifold economic growth and dominant leadership role



# Pain-sensing cells are either male or female, finds study

To understand sexual dimorphism in nociceptor sensitisation, researchers investigated how easily pain receptors in the dorsal root ganglion could be excited. They took samples from three male and female mice, two macaque monkeys, and donor nerve cells from four men and three women

Sanjukta Mondal

**Y**ou finally got your hands on a new novel you've been wanting to read. You're turning the crisp paper of the pages when suddenly you get a paper cut. Pain erupts on your finger. A disconcerting sensation surges through your entire body yelling out, "Brain, we have a problem!"

This unwanted yet necessary sensory experience most living beings share is pain. It is an essential component of our body's warning system that directs our attention to potential external or internal harm.

The International Association for the Study of Pain defines pain as, "An unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage."

The way people perceive pain is highly personal and subjective in nature. In fact, scientists have suspected for some time now that the perception of pain might be sexually dimorphic that is, different between (biological) men and women. But the particulars have been a mystery.

A study led by University of Arizona Health Sciences researchers, recently published in the journal *Brain*, demonstrated for the first time functional sexual dimorphism in nociceptors, the nerve cells responsible for perceiving pain.

## Why do we perceive pain?

Nociceptor cells have bare nerve endings, and they are found across our skin, bones, joints, and muscles. The receptors detect extreme pressure, temperature, and chemical signals released by the body when it is injured, turn them into electrical signals, and relay them to the brain via the spinal cord. The brain finally reads the message and perceives pain.

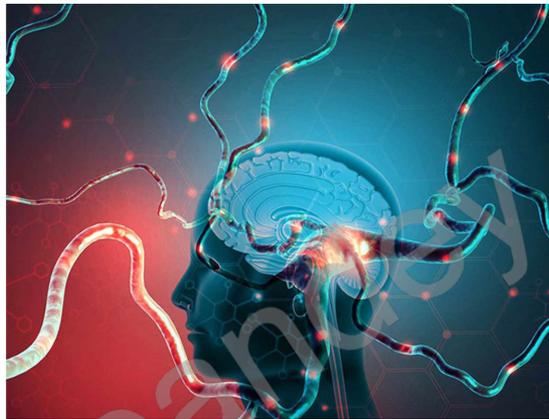
In the new study, the researchers investigated how the nociceptors **light up**. "Activation of nociceptors likely produces the same perception of pain in men and women. What is different is how the nociceptors are activated."

"While the nociceptors are normally activated by high-intensity stimuli, under some circumstances the threshold for their activation may be decreased, allowing low intensity and normally physiological stimuli to activate them and produce pain," Frank Porreca, associate head of the Department of Pharmacology, University of Arizona Health Sciences Center, told this author in an email.

## The nociceptor response threshold

Previous studies have reported that the nociceptor response threshold in females is lower than that in males. One possible biological mechanism underlying this difference could be peripheral nociceptor sensitisation: a phenomenon in which the threshold for pain is lowered by external factors, causing the receptors to respond to stimuli that they'd otherwise ignore. But researchers still needed to know how this variation in sensitisation arises.

To understand sexual dimorphism in nociceptor sensitisation, the research team investigated how easily pain receptors in the dorsal root ganglion – a cluster of nerve cells located near the spinal cord – could be excited. They



Pain is an essential component of our body's warning system that directs our attention to potential external or internal harm. GETTY IMAGES/ISTOCKPHOTO

collected the samples from three male and female mice, two macaque monkeys (one of each sex), and donor nerve cells from four men and three women.

Dr. Porreca's lab has been exploring the relationship between sleep and chronic pain. In an April 2022 study, the team found that prolactin, a hormone responsible for the growth of breast tissue, also selectively promoted pain responses in female rodents.

Later, the researchers found receptors for prolactin were expressed more in female-specific pain disorders such as endometriosis.

Their studies of sleep and chronic pain also established that orexin is a neurotransmitter that regulates wakefulness, produced sensitisation in male rodents but not female rodents.

## "Differentially sensitised"

In the new study, the researchers studied how prolactin and orexin B affect nociceptor activation thresholds in the nerve cell samples they had. They cultured the nerve cells overnight in the presence of mouse prolactin for the mice and human prolactin for both the monkey and the human samples. For orexin B, they applied the neurotransmitter to cultured nerve cells of all three species.

In the mice cohort, a technique to separate and identify proteins revealed prolactin had increased the firing up of nociceptors in females and orexin B had done the same thing in males. Immunohistochemistry analyses of monkeys and humans also revealed similar effects.

The team's observations here were consistent with the older findings. "Our paper showed that nociceptors from male



Scientists have suspected for some time now that the perception of pain might be sexually dimorphic that is, different between men and women. But the particulars have been a mystery

and female animals or humans can be differentially 'sensitised', i.e., have a lowering of their activation threshold." Dr. Porreca, the corresponding author of this study, said

## The devil's in the differences

When doctors prescribe medicine to help manage pain, they typically overlook the sex of the patient. In fact, other than certain female-specific hormonal therapies, health workers generally treat pain the same way among both men and women – even though we also know the rate at which different pain conditions occur differs between the sexes.

For example, pain arising from conditions not linked to visible tissue damage, such as irritable bowel syndrome, migraines, and painful bladder syndrome, is more common in women alongside female-specific issues such as endometriosis and dysmenorrhea.

On the other hand, cluster headaches and gout are more common in men, together with male-specific ailments like prostatitis.

Unravelling the different mechanisms that drive nociceptor sensitisation and activation will bring us a step closer to understanding qualitative sex differences

in pain perception, which in turn is essential to designing precise and sex-specific pain therapies.

We studied multiple species because we were aware of some data in rodents and human cells of differential expression of the transcripts for proteins, and we didn't know if this could translate into functional differences in sensitisation or activation," Dr. Porreca said.

Dr. Porreca said the widespread existence of these mechanisms across species suggests they're evolutionarily relevant.

In addition, the activation or sensitisation interfering ability of these mechanisms holds the potential to be exploited for the development of highly targeted therapeutics.

The study presents a unique concept: nociceptors are either male or female. The researchers expect their findings to have two implications for medical research.

First, it will encourage medical practitioners to factor in the sex of a patient when making decisions about pain therapies.

Second, in clinical trials of therapies with new pain treatment mechanisms, researchers will have to be more careful about the number of men and women in the trial so that they might be alerted to effects that may only occur in one sex.

Dr. Porreca also said it might be time to revisit some 'failed' clinical trials to check if there might have been a sex-specific effect to a drug.

(Sanjukta Mondal is a chemist-turned-science writer with experience in writing popular science articles and scripts for STEM YouTube channels.)



## Nociceptor cells

- **Nociceptor cells have bare nerve endings, and they are found across our skin, bones, joints, and muscles.**
- **The receptors detect extreme pressure, temperature, and chemical signals released by the body when it is injured, turn them into electrical signals, and relay them to the brain via the spinal cord.**
- **The brain finally reads the message and perceives pain.**



- **nociceptor sensitisation: a phenomenon in which the threshold for pain is lowered by external factors, causing the receptors to respond to stimuli that they'd otherwise ignore.**
- **dorsal root ganglion — a cluster of nerve cells located near the spinal cord**
- **orexin B, a neurotransmitter that regulates wakefulness, produced sensitisation in male rodents but not female rodents.**
- **The study presents a unique concept: nociceptors are either male or female.**



A painting created at least 51,200 years ago in the limestone cave of Leang Kapuang in the Maros-Pangkep region of the Indonesian island of Sulawesi depicts three human-like figures interacting with a wild pig, in this updated handout image. AP/REUTERS

## World's oldest cave painting was created at least 51,000 years ago

Reuters

On the ceiling of a limestone cave on the Indonesian island of Sulawesi, scientists have discovered artwork depicting three human-like figures interacting with a wild pig in what they have determined is the world's oldest known confidently dated cave painting – created at least 51,200 years ago.

The researchers used a new scientific approach to determine the minimum age of the newly disclosed painting inside the Leang Kapuang cave in the Maros-Pangkep region of South Sulawesi province by using a laser to date a type of crystal called calcium carbonate that formed naturally on top of the painting.

"The method is a significant improvement over other methods and should revolutionize rock art dating worldwide," said Maxime Aubert, a specialist in archaeological science at Griffith University in Australia and one of the leaders of the research published on Wednesday in the journal *Nature*.

The scene, dominated by a representation of a pig measuring 92 cm by 38 cm that is standing upright along with three smaller human-like figures, is painted in a single shade of dark red pigment. There are other images of pigs in the cave as well.

The researchers interpreted the

**Researchers used a laser to date a type of crystal called calcium carbonate that formed naturally on top of the painting**

painting as a narrative scene, which they said would make it the oldest known evidence of storytelling in art.

"The three human-like figures and the pig figure were clearly not depicted in isolation in separate parts of the rock art panel," said Griffith University archaeologist Adam Brumm, another of the study's leaders.

"Rather, the juxtaposition of the figures – how they are positioned in relation to each other – and the manner in which they are interacting were clearly deliberate, and it conveys an unmistakable sense of action. There is something happening between these figures. A story is being told. Obviously, we don't know what that story was," Brumm added.

The researchers used the same dating method to reassess the age of another Sulawesi cave painting from a site called Leang Bulu Sipong 4, also depicting a narrative scene, this time depicting apparent part human, part animal figures hunting pigs and deer buffaloes. It turned out to be at least 48,000 years old, upwards of 4,000 years earlier than previously thought.

"We, as humans, define ourselves as a species that tells stories, and these are the oldest evidence of us doing that," Aubert said.

In the Leang Kapuang painting, the interaction between the human-like figures and the pig, a species still inhabiting the island, is somewhat cryptic.

"Two of these figures are holding objects of some kind, and at least one figure seems to be reaching towards the pig's face. Another figure is positioned directly above the pig's head in an upside



SAURABH PANDEY

CSE

HOW TO CRACK UPSC EXAMINATION FROM RANKS TO TOP RANKING

# World oldest cave painting

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# Indigenous HPV vaccine, the rhetoric and the reality



India's public health sphere was subject recently to a one-sided discourse on how vaccination against the human papilloma virus (HPV) prevents cervical cancer and consequent death. Interestingly, it is not proven beyond doubt that HPV causes cervical cancer, as only a couple of strains out of 200 strains that infect humans are somehow 'associated' with 'pre-cancerous lesions'. Most of the women who die of cervical cancer are HPV positive, but most of the men and women who are HPV positive do not get virus-induced cancer, let alone die due to it.

The Population Based Cancer Registries (PBCR) of India and the International Agency for Research on Cancer (IARC) have acknowledged the declining trends of cervical cancer prevalence in India and the globe, regardless of vaccine coverage or efficacy. Therefore, the timing of the overzealous push for 'universal' vaccination of girls against HPV does serious injustice to the more justifiable 'selective' vaccination of high-risk groups, considering its sexual transmission, unlike air-borne, water-borne or contagious diseases. An extremely important western assumption behind targeting pre-puberty girls for this vaccine is that teenage girls indulging in promiscuous physical relations and becoming carriers of the virus are a huge risk factor for the entire adult population. This is a huge moral conundrum in Indian society and even reeks of patriarchy, as men can be carriers too.

## The path of vaccine manufacture

But this article focuses on the questionable timing, promotion and pricing of indigenous HPV vaccines, assuming some high-risk populations need it. The Serum Institute of India (SII) developed 'Cervavac' and promoted it as an indigenous and affordable vaccine. It is pertinent to ask why it took nearly two decades for the 'indigenous' vaccine after the introduction of a patented HPV vaccine in the United States, Australia and elsewhere in the Global North. Cervavac uses similar techniques, deploying virus-like particles (VLPs) produced using recombinant deoxyribose nucleic acid (rDNA) techniques to generate an immune response against HPV infections. The vaccine against cervical cancer is only the second rDNA vaccine in the world using the techniques of the early 1970s, the first being the vaccine against Hepatitis-B.

Prior to the development of rDNA methods, vaccine manufacture was largely a charitable or public sector enterprise with universal sharing of strains/techniques and little or no place for patenting of vaccines. The whole scenario changed with the amendment of the U.S. Patent Act in the 1980s allowing the patenting of genetically modified organisms (GMOs) and life processes, and the introduction of Bayh-Dole Act to legalise publicly funded scientists setting up companies. With the eventual globalisation of U.S. patent laws through the World Trade



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India's push for  
vaccination of  
girls against  
HPV raises  
questions on its  
timing,  
promotion  
and pricing

Organization Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) since 1995, vaccine development and innovation changed drastically.

Vaccine innovation underwent significant changes in terms of its organisation, patenting strategies and even distribution practices in academia and industry. An important element of this 'value addition' is legalisation of the conversion of public 'research' into private 'development' and its monopolisation by patenting. This facilitated the change of hands in vaccine development and production from the public to private sector or the world over, aided by the politics of liberalisation and globalisation. This was elaborated by William Muraskin in his book, *The Politics of International Health: The Children's Vaccine Initiative and the Struggle to Develop Vaccines for the Third World*, and, more recently, in a collection edited by Stuart Blume and Baptiste Baylac-Paouly, titled *Immunization and States: The Politics of Making Vaccine*, that included the Indian scenario. Developed under these new innovation conditions was the first vaccine for cervical cancer marketed as Gardasil by Merck and Cervarix by Glaxo Smithkline, globally.

## Impact on India

These developments impacted the Indian pharmaceutical and biotech industry in general and vaccine development in particular. Earlier, the Indian Patent Act (1970) abolished patenting products and allowed only processes, that too excluding agricultural and biological patents. This enabled the growth of domestic industries to become the pharmacy of the world within two decades. They manufactured low-cost generic drugs and vaccines, often within a couple of years after they were introduced in the global north. The first rDNA vaccine produced in India for hepatitis-B not only entered the market within five years under the process patent but also dropped the price to an order of magnitude cheaper than in the global north.

On the other hand, under the current product patent regime, a locally made DNA vaccine against cervical cancer had to wait for two decades till the expiry of the product patents before its indigenous 'generic' version was made available. The expiry of key patents of the HPV vaccine was recently reported by the World Health Organization and a highly cited article published in *Nature Biotechnology*.

While multinational patent monopolies largely explain the delay in developing a local vaccine, what still remains unexplained is the exorbitant current market price of Cervavac. Prior to the domestically manufactured vaccine, two prominent multinational vaccines (Gardasil and Cervarix) were sold in India for ₹4,000 a dose. Even at about half that price, a domestically manufactured vaccine in the private market remains largely unaffordable, keeping the vaccine out of reach for a large section of the target

population. What is even more worrisome is the unreasonable pricing strategy itself, as the price does not truly reflect the production costs. First, Indian industry is well equipped infrastructurally to make rDNA products at scale, particularly vaccines. Second, Cervavac development was funded heavily, which included nearly \$7 million by the Bill & Melinda Gates Foundation (BMGF) under its Grand Challenges Fund. Third, the infrastructure used in producing Cervavac was also a part of the production facility for the Covishield vaccine, built with significant support from the Indian government's Department of Biotechnology.

Such a shared use of resources must have reduced the actual input costs to enable more affordable pricing, thus raising doubts on the pricing strategy of the SII. It seems to be designed to capitalise on high-margins even at low trade volumes, rather than using economies of scale and low margin pricing to boost volume trade. This is essential for public health, as high population coverage is crucial for the success of any vaccine.

## Competing vaccines are scant

Another serious concern is the unavailability of other competing vaccines from domestic players, which could have put downward pressure on the current price of Cervavac. This is surprising given the fact that at least four different vaccine candidates were in the pipeline since 2010 from other domestic players. Shantha Biotechnics, Hyderabad, which produced a rDNA Hepatitis-B vaccine at a cheaper price pledged to bring an affordable HPV vaccine to the market by 2015, after it acquired licences from the National Institutes of Health and Johns Hopkins University in the U.S. This may have collapsed after Shanta was acquired by Sanofi Pasteur, Paris, which itself was associated with Merck's Gardasil in several ways. Nonetheless, Shantha Biotechnics, Indian Immunologicals, and Bharat Biotech, Hyderabad, and Zydus Cadila, Ahmedabad have all announced their HPV vaccines in the pipeline around the same period. Their unavailability despite the expiry of the earlier patent barrier is a matter of concern.

The Cervavac vaccine is currently recommended universally under the government vaccination programme for girls between the ages of nine to 26 at a price of ₹500 for two doses, which is expensive even for the government. For those millions who are left out of the government coverage, the retail price of Cervavac will shoot up four-fold to ₹2,000, in a country that has low insurance penetration and catastrophically huge out-of-pocket health expenditures. Therefore, even as the need for universal HPV vaccination to prevent cervical cancer remains an unresolved doubt, the lack of competition and opaque pricing merits investigation in the larger public interest.

*The views expressed are personal*

# Vaccine development



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Patents	Significance	India	Most other nations
<b>Process</b>	Any new invention in process or improvement in existing process	Applicable	Applicable
<b>Product</b>	Entirely new discovery	Applicable	Applicable
	Discovery of new use for known substance	Not Applicable as per section 3(d)	Applicable
	Discovery of new form of old substance with no enhancement of the known efficacy	Not Applicable as per section 3(d)	Applicable
	Mere discovery of a new property of known substance	Not Applicable as per section 3(d)	Applicable

# HPV

- HPV, or human papillomavirus, is a common virus that can cause cancers later in life.
- Human papillomavirus infection (HPV infection) is caused by a **DNA virus** from the *Papillomaviridae* family
- Many HPV infections cause no symptoms and 90% resolve spontaneously within two years.

# What is rDNA Vaccine ??



- In recombinant DNA vaccines, the antigens are not directly injected into the body.
- Instead the rDNA containing the gene for coding the antigen in a vector is incorporated into the body.
- The gene produces antigens inside the body and the immune responses are elicited for that antigen.
- Then the memory of the antigen is retained by the immune system.

# What are new provisions for police officers?

With the new criminal laws coming into effect, how have basic duties of police officers changed? What are some of the changed provisions with respect to arrests of elderly and infirm people? What about preserving electronic evidence? How can electronic evidence be stored?

## EXPLAINER

R.K. Vij

### The story so far:

**T**he new criminal laws have become effective from July 1. SOPs have been issued by the Bureau of Police Research and Development (BPRD) to guide police officers in implementing the new provisions.

### What are rules for registering FIRs?

The officer in-charge of a police station cannot refuse to register an FIR on the basis of lack of jurisdiction or disputed jurisdiction. He is legally bound to register (popularly known as a zero FIR) and transfer such a case to the respective police station. Though this practice was followed earlier too, the Bharatiya Nagarik Suraksha Sanhita (BNSS) now has a direct provision under Section 173; non-registration of FIRs may attract penal action under various sections.

Additionally, while information can be given orally or in writing as before, it may also be given by electronic means which is to be taken on record by the officer in-charge if it is signed within three days by the person giving it. While no one can stop a police officer from enquiring into the information immediately if it is of a sensitive nature, the electronic mode by which information may be given must be decided by the agencies, such as the Crime and Criminal Tracking Network and Systems (CCTNS) portal, the police website or officially published email IDs.

### What about videography?

The BNSS mandates videography during a search conducted by the police under Section 185; of the scene of crime (Section 176); and of the process of conducting a search of a place or taking possession of any property (Section 105). Since these are mandatory provisions, any negligence on the part of the police may benefit the accused persons. Therefore, investigating



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officers (IOs) must be provided electronic devices and proper training to discharge such functions.

A cloud-based mobile app, 'eSakshya' has been designed by the National Informatics Centre for enforcement agencies, which allows capturing multiple photos and videos. The photographs of witnesses and selfies of IOs may be captured using this app. Each item is geo-tagged and time-stamped to ensure the integrity of data. Since eSakshya is an initiative under the Inter-operable Criminal Justice System (ICJS), this data will be available to other agencies such as the judiciary, prosecution and cyber forensic experts.

### What about provisions of arrest?

Information about arrested persons is to be mandatorily displayed in police stations. Section 37 of the BNSS requires a

police officer in every police station, not below the rank of Assistant Sub-Inspector, to be responsible for maintaining and prominently displaying information about the arrested persons. Therefore, boards (including in digital mode) containing names, addresses and the nature of the offence must be put up outside police stations and district control rooms.

Some restriction has been imposed on the arrest of frail or sick and elderly persons. Section 35(7) states that the permission of an officer not below the rank of DySP is mandatory for arresting a person charged with an offence punishable for imprisonment of less than three years if such person is infirm or is above 60 years of age. Similarly, though the law now provides for the use of handcuffs in certain cases, the IOs must use them cautiously. The Supreme Court has laid down that handcuffing may be

done only when there is a possibility of escaping from custody or causing harm to himself or others.

### What about timelines?

In case of medical examination of a victim of rape, the registered medical practitioner is mandated under Section 184 (6) of the BNSS to forward the medical report to the IO within seven days, who shall forward it to the magistrate concerned. Therefore, doctors must be sensitised about the new law. The investigation of POCSO cases is required to be completed within two months of recording the information of the offence. Earlier, this time limit was only for rape cases under the Indian Penal Code.

A new provision under Section 193(3)(h) requires the IO to maintain the sequence of custody of an electronic device. Though maintaining a chain of custody is important for every seizure, emphasis is laid on electronic devices because they are sensitive pieces of evidence and more vulnerable to tampering. While every police officer is required to upgrade his skills about maintaining integrity of electronic records, the task of the (cyber) expert is likely to increase with many of the mandatory provisions coming into effect.

This sub-section also imposes a duty to inform the progress of the investigation within 90 days to the informant or victim.

Section 113 introduced in the Bharatiya Nyaya Sanhita (BNS) defines what is a 'terrorist act' and imposes the duty on an officer, not below the rank of Superintendent of Police (SP), to decide whether to register a case under this Section or the UAPA. Since, no guidelines are given to exercise this discretion, the SP may inter-alia consider factors such as whether the terrorist organisation is notified under the UAPA, approximate time needed to complete investigation, the rank of the IO and the level of scrutiny required, and how dangerous the accused person is.

R.K. Vij is a former Indian Police Service officer. Views are personal.

## THE GIST

The officer in-charge of a police station cannot refuse to register an FIR on the basis of lack of jurisdiction or disputed jurisdiction. He is legally bound to register (popularly known as a zero FIR) and transfer such a case to the respective police station.

Section 37 of the BNSS requires a police officer in every police station, not below the rank of Assistant Sub-Inspector, to be responsible for maintaining and prominently displaying information about the arrested persons.

A new provision under Section 193(3)(h) requires the IO to maintain the sequence of custody of an electronic device. Though maintaining a chain of custody is important for every seizure, emphasis is laid on electronic devices because they are sensitive pieces of evidence and more vulnerable to tampering.





## What are rules for registering FIRs?

- **The officer in-charge of a police station cannot refuse to register an FIR on the basis of lack of jurisdiction or disputed jurisdiction.**
- **He is legally bound to register (popularly known as a zero FIR) and transfer such a case to the respective police station.**
- **Though this practice was followed earlier too, the Bharatiya Nagarik Suraksha Sanhita (BNSS) now has a direct provision under Section 173; non-registration of FIRs may attract penal action under various sections**

## What about videography?

- The BNSM mandates videography during a search conducted by the police under Section 185; of the scene of crime (Section 176); and of the process of conducting a search of a place or taking possession of any property (Section 105).
- A cloud-based mobile app, 'eSakshya' has been designed by the National Informatics Centre for enforcement agencies, which allows capturing multiple photos and videos.

## What about provisions of arrest?

- Information about arrested persons is to be mandatorily displayed in police stations.
- Section 37 of the BNSS requires a police officer in every police station, not below the rank of Assistant Sub-Inspector, to be responsible for maintaining and prominently displaying information about the arrested persons.
- Therefore, boards (including in digital mode) containing names, addresses and the nature of the offence must be put up outside police stations and district control rooms



- **Section 35(7) states that the permission of an officer not below the rank of DySP is mandatory for arresting a person charged with an offence punishable for imprisonment of less than three years if such person is inform or is above 60 years of age.**
- **Similarly, though the law now provides for the use of handcuffs in certain cases, the IOs must use them cautiously**



- **new provision under Section 193(3)(h) requires the IO to maintain the sequence of custody of an electronic device.**
- **Though maintaining a chain of custody is important for every seizure, emphasis is laid on electronic devices because they are sensitive pieces of evidence and more vulnerable to tampering.**



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## THE GIST

▼ The Delhi Preservation of Trees Act (DPTA), 1994 provides legal protection to trees in the national capital against actions that could harm their growth or regeneration.

▼ Delhi's forest cover constitutes 13.15% of its geographical area, while its tree cover spans 147 sq. km (9.91%).

▼ Amid an extreme heatwave, rampant tree felling in the world's second most populous city will only worsen hardships faced by the people.

# What are the laws preventing tree felling in Delhi?

What is the extent of the national capital's green cover? What does Delhi Preservation of Trees Act mandate?

## Kartikey Singh

### The story so far:

**O**n June 26, a Vacation Bench of the Supreme Court (SC) directed the Delhi government and Delhi Development Authority (DDA) to take effective steps to enhance the national capital's green cover amidst the extreme heat wave.

### What is the extent of the green cover?

According to the 'India State of Forest Report 2021' (ISFR) published by the Forest Survey of India (FSI), Delhi has the largest forest cover among seven major megacities, with 195 sq. km, followed by Mumbai (110.77 sq. km) and Bengaluru (89.02 sq. km). Delhi's forest cover constitutes 13.15% of its geographical area, while its tree cover spans 147 sq. km (9.91%). Despite extensive urban development, the city's overall green cover (forest and tree cover) has increased from 151 sq. km (10.2%) in 2001 to 342 sq. km (23.6%) in 2021.

### What about their protection?

The Delhi Preservation of Trees Act (DPTA), 1994 provides legal protection to trees in the national capital against actions that could harm their growth or regeneration. According to Section 2 (h) of the Act, "to fell a tree" includes severing the trunk from the roots, uprooting, bulldozing, cutting, girdling, lopping, pollarding, applying arboricides, burning, or any other damaging method. Under Section 8, no tree or forest produce can be removed on any land without prior permission from the 'Tree Officer', even on privately owned property. The 'Tree Officer' may grant permission after inspection and must respond within 60 days. Any person violating this Act may face imprisonment for up to one year, a fine up to ₹1,000, or both. Furthermore, the Act outlines a 'Tree Authority' tasked with conducting tree censuses, managing nurseries, and reviewing government and private construction proposals, among other responsibilities. In addition, Delhi's Tree Transplantation Policy, 2020

mandates that 80% of identified trees slated for felling must be transplanted. However, an affidavit submitted by the government to the Delhi High Court in 2022 disclosed that out of the 16,461 transplanted trees since the policy's notification, only 33.33% had survived.

### What is the case against the DDA?

The apex court is hearing a contempt petition against DDA's Vice Chairman Subhashish Panda for the felling of about 1,100 trees, in violation of the SC's orders, for road expansion in the ridge area, which falls under the eco-sensitive zone around Asola-Bhati Wildlife Sanctuary. On March 4, the DDA submitted an application to the SC seeking permission to cut trees for the construction of the Gaushala Road. However, the court directed the DDA to re-examine the proposal with the help of field experts. During the proceedings, an affidavit from the DDA's Vice Chairman revealed that tree felling had already begun on February 16 and continued for ten days.

So, by February 26, all intended trees were cut down even before the application reached the SC. This material fact was not disclosed when the court heard the application on March 4. Despite knowing no trees could be touched without the court's sanction, the DDA misled the court and acted in bad faith by seeking permission only after the tree felling work. While probing deeper to set accountability, the Bench pulled up DDA for not providing records of the Delhi LG's (Chairman of the DDA) February 3 visit to the site, which allegedly led to the tree felling order. The Delhi government was also reprimanded for usurping the Tree Officer's authority in granting permission.

The apex court has halted the DDA's work and directed a team from the FSI to assess the number of trees cut and the environmental damage.

### What next for Delhi?

Amid an extreme heatwave, rampant tree felling in the world's second most populous city will only worsen hardships. Urban forests act as carbon sinks, absorbing emissions and filtering pollutants, essential for cities like Delhi with persistently unhealthy air quality indices. Trees reduce the urban heat island effect by lowering temperatures through shading and evapotranspiration. Among other reforms, the government should consider increasing the penalty from ₹1,000 to ₹5,000 under the DPTA, 1994, aligning it with current realities.

*Kartikey Singh reads law at RGNUL.*

## **The Delhi Preservation of Trees Act (DPTA), 1994**

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- **Amid an extreme heatwave, rampant tree felling in the world's second most populous city will only worsen hardships faced by the people.**



**Looking forward:** On the occasion of World Environment Day, a new fleet of 175 Electric Vehicle (EV) Airport Taxis were introduced on June 5 in Bengaluru.

# In an electric vehicle, what is regenerative braking?

Regenerative braking is a system designed to convert the kinetic energy of the wheels to a form that can be stored and used for other purposes. Here the motor operates as a generator, turning mechanical energy back to electrical energy.

**Yasudevan Makunth**

The impulse to be sustainable – driven by the incessant pressure to lower our emissions – often manifests as lowering consumption and increasing reuse alongside reforms like tweaking consumer behaviour. Electric vehicles are the site of many of these changes, aided by state-led incentives and subsidies. Regenerative braking is an important mechanism in these vehicles that increases their energy use efficiency.

### What is braking?

Braking is the mechanism by which an automotive vehicle in motion slows down. A vehicle moving faster has more kinetic energy than a vehicle moving slower, so the process of braking removes (mostly) kinetic energy from the vehicle. The law of energy conservation means that removed energy has to go somewhere.

For example, the disc brake is one type of mechanical brake: it works by pressing brake pads against a disc attached to spinning wheels, and uses friction to convert some of the wheels' kinetic energy into heat. This is why the discs of disc brakes have holes cut into them, to dissipate heat better.

Another type is the induction brake, often used in trains: a magnet induces circular electric currents in a spinning wheel (made of a conducting material, like metal). These currents produce their own magnetic field, which opposes that of the external magnet. The opposition acts like a drag on the wheel and forces it to slow down. In terms of energy, the metal resists the flow of the circular currents and dissipates heat.

### What is regenerative braking?

Regenerative braking is a brake system designed to convert the kinetic energy of the wheels to a form that can be stored and used for other purposes. As such, it creates a process in which at least part of the energy delivered to the vehicle's wheels can be recovered in a situation when the vehicle doesn't need it.

Regenerative braking is one type of dynamic braking. In an electric vehicle, of the types becoming common on Indian roads, a battery onboard the vehicle draws electrical power from the grid and stores it. When the vehicle moves, the battery operates an electric motor that

propels the vehicle, converting electrical to mechanical energy. This motor is called the traction motor.

During regenerative braking, the motor operates as a generator, turning mechanical energy back to electrical energy. In the vehicle, this means an electric current will be produced as the vehicle brakes, which is stored separately in a battery. In some other vehicles, especially trains, the current is fed back into the traction motor. The other type of dynamic braking is rheostatic braking, where the current is sent to an array of resistors that dissipate the electrical energy as heat. It is often necessary for a vehicle to have both regenerative and rheostatic braking in case the electrical energy recovered can't be stored or used right away.

### How does motor become a generator?

A motor has two essential parts: a rotor (the thing that rotates) and a stator (the thing that's stationary). In a rudimentary design, the stator consists of permanent magnets or electromagnets while the rotor consists of current-carrying wires coiled around in loops. The stator surrounds the rotor.

When a charged particle, like an electron, moves inside a magnetic field, the field exerts a force on the particle called the Lorentz force. When the force will push or pull the wire in which the electron is moving depends on the direction of the electric current.

This is when the coil helps. The current at the coil's two ends moves in opposite directions, so the magnetic fields imposed by the stator will push on one end of the coil and pull on the other. And these opposing forces will continue to act on the two sides of the rotor until the voltage across the wire is constant. Thus, a motor converts electrical energy to rotary motion.

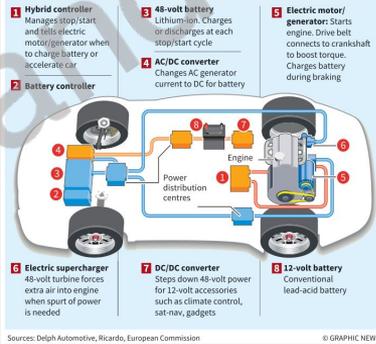
In a generator, mechanical energy from an external source can be fed to the rotor to induce a current in the stator. Simply speaking, by switching the traction motor between these two configurations, an electric (or hybrid) vehicle can implement regenerative braking.

### Does regenerative braking have downsides?

While it is a simple energy recovery mechanism, regenerative braking has some downsides. For example, it alone

## The mechanics of brake energy generation

Regenerative braking is a type of dynamic braking. Here the motor operates as a generator, turning mechanical energy back to electrical energy. In the vehicle, this means an electric current will be produced as the vehicle brakes, which is stored in a battery.



often doesn't suffice to bring an electric vehicle to a halt.

It has to be used together with a conventional system that dissipates some of the kinetic energy as heat.

Such a system is also required to prevent vehicles from backsliding downhill, which many regenerative brakes won't prevent.

Another example is that the amount of energy a regenerative brake can recover drops as the vehicle's velocity drops as well. This said, a regenerative brake can be beneficial for an electric vehicle's energy-use efficiency in stop-start traffic.

### Are there other ways to recover energy?

The design of a regenerative brake depends on the energy form to which the mechanical energy from the wheels is to be converted. An electric vehicle's

it into a generator and obtains a current, which is stored in a battery or a supercapacitor. Similarly, the mechanical energy can be used to increase the angular momentum of a rotating flywheel. Flywheels are especially useful because they can receive energy much faster than other such systems.

For every unit increase in speed, they also store exponentially more energy. Engineers have been able to build flywheels with carbon-composites that, in a vacuum, can spin at up to 50,000 rpm. The flywheel can be linked to a reciprocating engine to manage or augment its output, like in Formula One racing, or to a gyroscope to help submarines and satellites navigate.

Recovered kinetic energy can also be fed to a pump that compresses air, which can be useful to start internal combustion engines.

## What is regenerative braking?

- **Regenerative braking is a brake system designed to convert the kinetic energy of the wheels to a form that can be stored and used for other purposes.**
- **As such, it creates a process in which at least part of the energy delivered to the vehicle's wheels can be recovered in a situation when the vehicle doesn't need it.**
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# Japan and Philippines sign defence agreements

**Associated Press**  
MANILA

Japan and the Philippines signed a key defence pact on Monday allowing the deployment of Japanese forces for joint drills in the Southeast Asian nation that came under brutal Japanese occupation in the Second World War but is now building an alliance with Tokyo as both face an increasingly assertive China.

The Reciprocal Access Agreement, which similarly allows Filipino forces to enter Japan for joint combat training, was signed by Philippine Defence Secretary Gilberto Teodoro and Japanese Foreign Minister Yoko Kamikawa in a Manila ceremony witnessed by President Ferdinand Marcos Jr.

It would take effect after ratification by the countries' legislatures, Philippine and Japanese officials said.

Ms. Kamikawa called the signing of the agreement "a groundbreaking achievement" that should further boost defence cooperation between the countries.

The officials on both sides "expressed serious concern over the dangerous and escalatory actions by China" in Second Thomas Shoal, the scene of a recent confrontation between China and the Philippines in the South China Sea.

The busy sea passage is a key global trade route which has been claimed virtually in its entirety by China but also contested in part by the Philippines, Vietnam, Malaysia, Brunei and Taiwan.



## The Reciprocal Access Agreement

- **Japan and the Philippines signed a key defence pact allowing the deployment of Japanese forces for joint drills in the Southeast Asian nation that came under brutal Japanese occupation in the Second World War but is now building an alliance with Tokyo as both face an increasingly assertive China.**
- **The Reciprocal Access Agreement, which similarly allows Filipino forces to enter Japan for joint combat training**



## Under water



**All hands on deck:** Rescue workers riding a boat past an inundated house on Sunday during flooding caused by a dam breach in Dongting lake in China's Hunan province. The breach occurred on Friday, inundating farmland and forcing nearly 6,000 people to evacuate. AFP

# Dongting Lake

- Dongting Lake is a large, shallow **lake** in northeastern **Hunan Province, China**.
- It is a flood basin of the **Yangtze River**, so its volume depends on the season.
- The provinces of **Hubei** and Hunan are named after their location relative to the lake: *Hubei* means "North of the Lake" and *Hunan*, "South of the Lake".
- Dongting Lake is famous in Chinese culture as the place of origin of **dragon boat racing**

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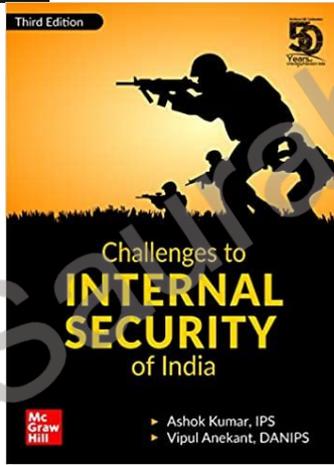
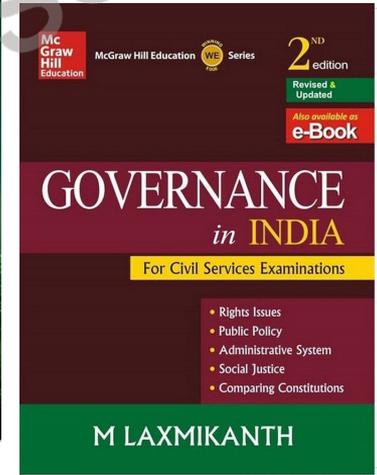
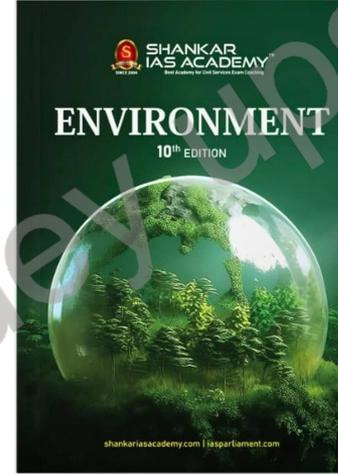
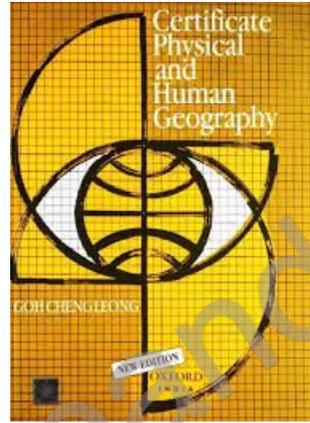
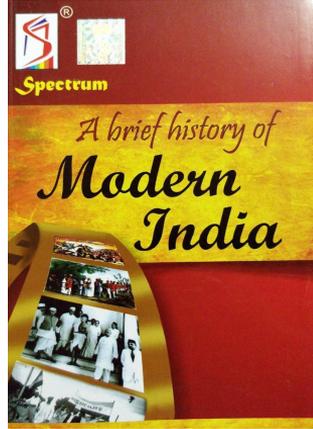
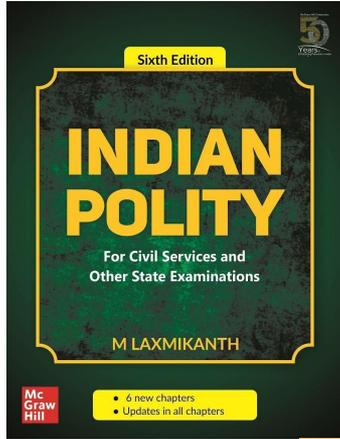
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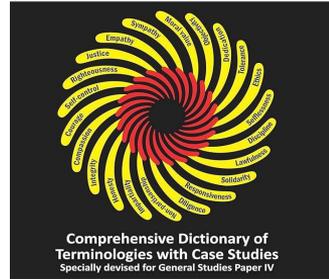
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