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By saurabh Pandey

THE HINDU

Target Mains -2024/25

Q Explain the impact of climate change on tectonic activities

प्रश्न टेक्टोनिक गतिविधियों पर जलवायु परिवर्तन के प्रभाव की व्याख्या करें

This worm develops food habits and its offspring ‘inherit’ them

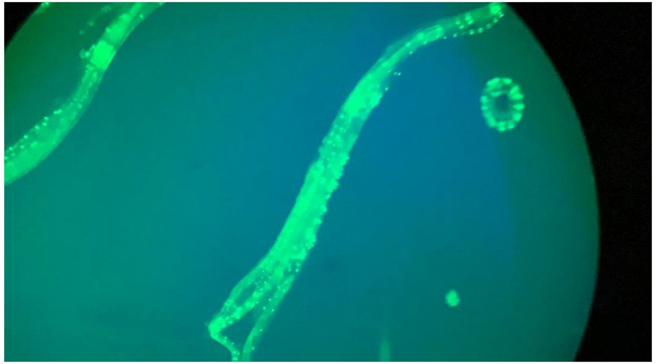
Researchers from Princeton University have reported that after the *Caenorhabditis elegans* worms ate a disease-causing strain of bacteria, its progeny were born with the ‘knowledge’ to avoid making the same mistake for up to four generations

D.P. Kasbekar

Researchers fondly call the roundworm *Caenorhabditis elegans* “the worm” because of its widespread use in research to understand neuronal and molecular biology. It was the first multicellular organism to have its full genome sequenced and neural wiring mapped. *C. elegans* grows within 3-5 days from a fertilised egg to a millimetre-long adult, and it has informed profound insights into the human body, as well as biology more broadly.

On March 28, researchers from Princeton University in the U.S. reported that after *C. elegans* worms ate a disease-causing strain of bacteria, its children inherited the ‘knowledge’ to avoid making the same mistake – up to four generations. Their findings were published in the journal *PLoS Genetics*.

Given the mechanism by which this transmission occurs, the study raises questions about whether humans could have the same ability.



Caenorhabditis elegans was the first multicellular organism to have its full genome sequenced and neural wiring mapped. ITI/WIKIMEDIA COMMONS (CC BY-SA 4.0)

Message in a bottle

Pseudomonas vranovensis is a disease-causing bacterium found in *C. elegans*’s natural environment.

The researchers found that *P. vranovensis* makes a small RNA molecule called sRNA. When the worms ingest this strain, they also take in the sRNA. The sRNA then altered the worm’s feeding behaviour such that, from that point on, the worms ‘know’ to avoid feeding on this bacterium and save themselves from getting sick.

Remarkably, this learned avoidance behaviour was found to be transmitted to the trained worm’s progeny, grand-progeny, great-grand progeny, and great-great-grand progeny. The ability decayed only from the fifth generation.

The same team of researchers had previously discovered this trans-generational ability in *C. elegans* worms against *P. aeruginosa* bacteria (which also cause disease in humans). In the new study, they were able to confirm *C. elegans* worms in the wild had the same ability.

Understanding RNA, large and small

A DNA molecule is like a big ladder. Its two side rails, or strands, are made of a long series of alternating units of phosphate and the sugar deoxyribose molecules. Each sugar unit is attached to one of four chemical bases: adenine (A), cytosine (C), guanine (G), and thymine (T). The As and Cs on one strand are bonded with Ts and Cs on the other by hydrogen bonds. These bonds form the rungs that hold the strands together.

A single *P. vranovensis* bacterium has 6-7 million rungs in its DNA, coding for about 5,500 genes. A gene is a segment of a few thousand base-pairs of the DNA molecule. Every gene is instructions that tell a cell how to make a protein.

In contrast to DNA, the RNA molecule is like a half-ladder or a comb. Its spine is made up of alternating units of phosphate and the sugar ribose. Each ribose molecule is attached to one of four bases: A, C, G or uridine (U), which jut out from the strand like the comb’s tines. A cell copies the sequence of As, Ts, Cs, and Gs in a gene in the DNA into the sequence of Us, As, Gs, and Cs in an RNA molecule. This RNA is called the messenger (mRNA). The length of this mRNA is comparable to that of the gene from which it is derived. The mRNA moves to structures called ribosomes, where the cell assembles the corresponding protein.

Diet control

But not all genes encode mRNAs and proteins. The end product of some genes, especially small genes that are only about a tenth as long (100-200 rungs) is sRNA. These sRNA bind to other proteins and RNAs, and either enhance or reduce the expression of other genes.

The Princeton University researchers showed that a *C. elegans* worm took up a 124-tine sRNA from an ingested *P. vranovensis*. This sRNA reduced the expression of a gene in the worm called *maco-1*, which plays an important neurological role. As it happens, *maco-1* is also found in humans.

> *C. elegans* grows within 3-5 days from a fertilised egg to a millimetre-long adult, and it has informed profound insights into the human body, as well as biology more broadly

In the laboratory, the researchers reared *C. elegans* worms on a diet of *Escherichia coli* bacteria. When the researchers engineered the *E. coli* to express the *P. vranovensis* sRNA and fed them to the worms, the worms learned to avoid the pathogenic strains of *P. vranovensis*. When these worms had children, the latter also had the ability to avoid pathogenic *P. vranovensis*.

Good ‘memory loss’

Another *Pseudomonas* bacterium, *P. mendocina*, is also present in the worm’s habitat but it doesn’t cause disease. Instead, *P. mendocina* is a source of nutrition. *C. elegans* worms trained to avoid the pathogenic *P. vranovensis* strain avoided feeding on the non-pathogenic *P. mendocina* as well. The researchers have speculated that this is perhaps why the ‘loss of memory’ happens around the fifth generation – so they can re-remember the advantage of consuming *P. mendocina*.

The sRNA that triggered learned avoidance behaviour came initially from the bacteria and was taken up by the worm that fed on them. Thereafter, the sRNA was maintained in the worms’ bodies, transmitted to their descendants, and maintained in them. This happened through a mechanism called RNA interference – which scientists first discovered by studying *C. elegans* worms.

Food for thought

In fact, discoveries based on studying *C. elegans* were recognised by Nobel Prizes in 2002, 2006, and 2008. This tiny worm has played an outsized role in the advancement of scientific and medical research.

For example, a gene that triggers a process during *C. elegans*’s development has been found in the human genome, and mutations in it have been associated with limb deformities.

So a question arises: whether our bodies can also take up sRNA molecules from the microbes in our gut, mouth or vagina, and whether they can modify our behaviour, and possibly the behaviour of our children and later generations.

(D.P. Kasbekar is a retired scientist.)

THE GIST

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What is sRNA ??

Bacterial small RNAs (sRNAs) are an emerging class of regulatory RNAs of about 40–500 nucleotides in length and, by binding to their target mRNAs or proteins, get involved in many biological processes such as sensing environmental changes and regulating gene expression.

WHAT IS IT?

Negativity bias: Why bad news sticks

Arkatapa Basu

Negativity bias is a psychological tendency ingrained in humans. It is characterised by a heightened sensitivity to negative stimuli over positive ones. Thanks to this bias, we notice negative events more readily as well as dwell extensively on them. It manifests in various aspects of life, from our ability to retain memories to social interactions.

This bias is also why a negative first impression can be challenging to overcome while past traumas tend to have enduring effects. Psychologist Rick Hanson has attributed this bias to millions of years of evolution — during which our ancestors faced constant threats in their environments. In these hostile conditions, their bodies and minds placed a premium on being able to spot and respond to threats.

The resulting evolutionary strategy ensured the survival of our species as well as selected for those individuals who were better able to sidestep or survive threats than others. These members then passed on their genes to modern humans, reinforcing the need for the bias in subsequent generations.

Today, the negativity bias affects how we perceive and remember events, interactions, and feedback. It explains why criticism sticks much more than praise and why negative news items often garner more attention than optimistic, affirmative stories.

Thanks to negativity bias, we notice negative events more readily as well as dwell extensively on them. GETTY IMAGES/ISTOCKPHOTO

Understanding negativity bias offers insight into human behaviour and cognition, and highlights the interplay between evolutionary heritage and modern psychological phenomena.

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Afghans gather near a flooded area between Samangan and Mazar-i-Sharif following a flash flood triggered by heavy rainfall in the Samangan province, on Friday. At least 62 people, mainly women and children, were killed on May 10 in flash floods that ripped through Afghanistan's Baghlan province, in the north of the country, a local official said. On Saturday, the official death toll stood at 153. AFP

Why Flash Floods in Afghanistan ??

- **Flash floods are floods that rise and fall rapidly with little or no advance warning .**
- **They are usually caused by intense rainfall, or a sudden outburst of a landslide dam or glacial lake, the rapid melting of snow, or by failure of artificial hydraulic structures. In this chapter, we concentrate on the first three causes.**
- **Flash floods are common in mountainous regions. Afghanistan is prone to flash floods because of its steep slopes in headwaters .**
- **Flash floods occur mainly as a result of heavy rainfall combined with rapid snowmelt, mostly during the spring months.**

- **Besides water, flash floods carry considerable amounts of debris. Amu River, for example, has an elevation difference of 2700 m between Pamir and Kham Ab and carries about 250 million cubic metres of sediment from flash floods every year.**
- **The river erodes large areas of land in Afghanistan.**
- **In general, Hairatan district in the north, and Harirood and Farahrood rivers (Hilmand basin) in the western part, are flash flood-prone.**
- **Lack of vegetation and denudation of the mountain areas are the major causes of flash floods. In recent years, flash floods have been occurring more frequently and with increasing ferocity in countries like Afghanistan.**

WEATHER

More than 300 killed in Afghanistan floods

Flash floods have killed more than 300 people in Afghanistan's northern Baghlan province. Many others remain missing. Authorities have declared a state of emergency and rushed to rescue the injured.

NH construction slows as funds go scarce, hybrid annuity model falters

From 34 km per day in FY24, the pace of national highway construction is expected to slow to 31 km per day; influx of mid-level developers with moderate credit profiles, especially after March 2020, blamed; projects under hybrid annuity model haven't taken off as anticipated

NEWS ANALYSIS

Rishi Ranjan Kala

From 34 km per day in FY24, the pace of national highway construction is expected to slow to 31 km per day. Credit rating agency CareEdge Ratings expects the execution pace to decline by 7-10% year-on-year – from 12,350 km in FY24 to about 11,500 km in FY25.

Among other factors, the blame is being laid on the influx of mid-level developers with moderate credit profiles, especially after March 2020. The drastically expanded pool of bidders led to lower bids, but heightened the execution risks, including funding hurdles and other delays, analysts say. To make matters worse, projects under the hybrid annuity model (HAM) – a public-private partnership (PPP) model that combines engineering, procurement, and construction (EPC) and build, operate, transfer (BOT) models – haven't taken off as anticipated.

Maulesh Desai, Director, CareEdge Ratings, says other key challenges facing the roads sector include land acquisition hurdles and delays in the 'appointed date' – namely the handover of the contract letter to the successful bidder, enabling commencement of work. Of the ₹1.5-lakh-crore HAM projects awarded after March 2020, nearly one-third are delayed by 4-6 months beyond the three-month grace period.

Hitting a roadblock: The RBI's recent draft guidelines on project financing have left embattled construction firms anxious about the implications for under-construction infra projects. PTI

Their aggregate 'bid project cost' (BPC) – the lowest lifecycle cost of the project, which includes construction, operation and maintenance – is ₹50,000 crore. The developers have applied for or received an extension for a similar or longer period, CareEdge says.

Notably, another significant chunk of HAM projects are awaiting an 'appointed date' for more than a year; their aggregate BPC is about ₹40,000 crore, as of April 1, 2024, compared with ₹14,500 crore, as of June 30, 2023, the rating agency says. HAM projects for 2,200-plus km of national highways remain non-starters even a year after they were awarded.

> CareEdge Ratings expects the execution pace to decline by 7-10% year-on-year – from 12,350 km in FY24 to about 11,500 km in FY25

Daleep Thusu, Senior Vice President of infrastructure consultancy Rudrabhishek Enterprises, says while HAM was seen as the "next big thing" in 2020, it had since fallen short, likely due to pandemic-related disruptions.

"Delays in project completion, cost escalations, and revenue uncertainties may have affected the attractiveness of the model [HAM] for private developers," he surmises. Moreover, the government's budgetary constraints and shift in focus to economic recovery may have reduced the outlay for infrastructure projects, thereby impacting HAM projects, he says.

Regulatory clarity

InCoBAN, an infra-construction industry improvement ecosystem, observes that since March 2020 competition intensified in the roads sector, with the entry of mid- to small-sized sponsors of moderate credit standing, leading to execution risks, delays and funding scarcity. "Moreover, unexpected events such as COVID-19, post-bidding commodity price hikes, prolonged monsoons, and stringent debt terms have exacerbated the delays," says InCoBAN co-founder Abhilasha Panwar. To remedy this, Ms. Panwar suggests stepping up project supervision, alongside exploring alternative funding sources such as multilateral organisations. "Simplifying approval processes, addressing regulatory hurdles, and nurturing collaboration among stakeholders can enable seamless implementation," she adds.

Echoing this, Mr. Thusu stresses the need for a concerted effort by government agencies, developers, financiers, and other stakeholders to expedite HAM projects. "It calls for removing regulatory bottlenecks, enhancing preparedness, collaboration, embracing technology and innovation, skills development, and a conducive policy environment," he says.

Ms. Panwar points out that clarity in regulatory guidelines not only fosters private sector participation but also encourages engagement in HAM initiatives.

Project finance worries

The Reserve Bank of India's recent draft guidelines on project financing have added another layer of worry for embattled construction companies, which are anxious about the implications for under-construction infrastructure projects.

Rajashree Murkute, a senior director at CareEdge Ratings, says the draft guidelines hold out challenges for both under-construction and operational infrastructure projects. "A mandatory tail-period accounting for 15% of a project's economic life will restrict the ability of infrastructure projects to secure additional top-up loans. CareEdge Ratings estimates that this will necessitate an 8-10% increase in equity requirements for HAM-based road projects to align the loan tenure with 85% of the economic life for concessions lasting 15 years," she explains.

Defining a specific credit event and implementing a resolution plan in a time-bound manner call for increased monitoring and timely reviews from all stakeholders, she adds.

Infrastructure projects, being capital-intensive, are sensitive to changes in interest rates. Consequently, a significant rise in provisioning requirements, from 0.4% to 5%, during the construction phase is likely to diminish the bidding appetite of developers in the medium term, she cautions.

(The writer is with The Hindu businessline)

What is Hybrid Annuity Model (in PPP)?

tojo jose
January 28, 2016

The government has decided to introduce Hybrid Annuity Model (HAM) to revive PPP (Public Private Partnership) in highway construction. At present, three different models –PPP Annuity, PPP Toll and EPC (Engineering, Procurement and Construction) were followed by the government while adopting private sector participation.

Launch of the new model is due to the many problems with the existing ones. Large number of stalled projects are blocking infrastructure projects and at the same time adding to NPAs of the banking system.

In this context, the government has introduced Hybrid Annuity Model (HAM) to rejuvenate PPP.

By features the HAM is a mix between the existing two models – BOT Annuity and EPC. Hence to understand the HAM, we should know the basic features of the existing PPP models.

1. The Build Operate and Transfer (BOT) Annuity Model

Under BOT annuity, a developer builds the highway, operates it for a specified duration and transfers it back to the government. The government starts payment to the developer after the launch of commercial operation of the project. Payment will be made on a six month basis.

2. BOT Toll Model

In this toll based BOT model, a road developer constructs the road and he is allowed to recover his investment through toll collection. This toll collection will be over a period of nearly 30 years in most cases. There is no government payment to the developer as he earns his money invested from tolls.

3. **Engineering, Procurement and Construction (EPC) Model**

Under this model, the cost is completely borne by the government. Government invites bids for engineering knowledge from the private players. Procurement of raw material and construction costs are met by the government. The private sector's participation is minimum and is limited to the provision of engineering expertise. A difficulty of the model is that financial is the high financial burden for the government.

What's Hybrid Annuity Model?

- **The government funds** 40% of the project cost (construction support) in instalments, which are linked to physical progress
- **A private player**, who is selected through a bidding process, will have to bear 60% of the cost through a combination of debt and equity

- **Revenue source:** The state government will be in charge of toll collection

Investment lessons from the India-EFTA trade deal

Prabhash Ranjan

is a Humboldt Fellow, Max Planck Institute, Heidelberg, and Professor, Jindal Global Law School

India's free trade agreement (FTA) negotiations with countries such as the United Kingdom and the European Union (EU) seem to be on ice due to the ongoing parliamentary elections in India. However, before election fever gripped the country, India managed to clinch a historic trade deal, in March, with the European Free Trade Association (EFTA), comprising Iceland, Liechtenstein, Norway and Switzerland. The newly minted Trade and Economic Partnership Agreement (which we refer to as FTA) between India and EFTA is expected to give a much-needed leg-up to the low levels of extant trade between the two sides. The FTA between India and EFTA is also important because, as economist Biswajit Dhar has argued, India has agreed to include issues such as environment and labour, which it has traditionally opposed incorporating in trade agreements.

On investment

Another reason sets this FTA apart from those India signed recently with countries such as Australia, the United Arab Emirates (UAE), and Mauritius. The India-EFTA FTA includes a somewhat detailed investment chapter, which is missing in the other recent Indian FTAs. This chapter focuses on investment facilitation issues, not investment protection. But it has a remarkable and unprecedented characteristic. India has managed to extract a promise from the EFTA countries that they shall "aim to" increase foreign direct investment (FDI) to India to $50 billion within 10 years of the FTA coming into force, followed by another $50 billion in the succeeding five years. Likewise, Article 7.1(3)(b) of the investment chapter provides that the EFTA states shall "aim to" facilitate the generation of one million jobs in India. In legal terms, these articles codify what is known as an obligation of conduct – an obligation to make an honest endeavour towards achieving a goal, notwithstanding the outcome or the result. This differs from an obligation of result, which would require achieving a specified outcome. In other words, the EFTA countries are legally obligated to make an honest effort to invest $100 billion and generate one million jobs in India. They are not required to realise these outcomes. Nonetheless, the Indian negotiators need to be complimented for incorporating such path-breaking specified obligations of conduct in the investment chapter, which are typically not found in FTAs or investment treaties. Notably, this creates a template worth emulating in the ongoing negotiations with the U.K., the EU, and other countries.

India needs a clear free trade agreement policy, especially in dealing with international trade and foreign investment laws

Trade and investment

Economic theory has long demonstrated the inextricable linkage between trade and investment. This is truer in a world where the production process is scattered along global supply/value chains, a function of trade and investment. Thus, unsurprisingly, FTAs routinely contain binding rules on both trade and investment. India's FTAs signed in the first decade of this century with countries such as Japan, Korea, Malaysia and Singapore are based on this economic logic. In addition to binding trade rules, they all contain an investment chapter with provisions for protecting investment. However, India departed from this model as part of its FTA 2.0 approach. In other words, India decoupled international trade law from international investment law. This is evident in its FTAs with Australia, Mauritius, and the UAE which contain binding trade but not investment rules. India's approach seems to be to have separate agreements on trade and investment with the same country. This is most markedly seen in the case of the UAE. After signing the FTA with the UAE in 2022, New Delhi and Abu Dhabi entered into a bilateral investment treaty earlier this year. India follows a similar decoupling approach to the U.K., where trade and investment agreements are seemingly negotiated as two disparate treaties.

In this context, the India-EFTA FTA, which contains an investment chapter within the trade agreement, assumes pivotal significance. Can it be said that India has decided to move away from the decoupling of trade and investment law in its FTAs and is going back to the template followed in the early 2000s? It is too early to say that the India-EFTA FTA will be a bellwether for future FTAs.

FTA 3.0

India needs a clear FTA policy, especially in dealing with international trade and foreign investment laws. Suppose India expects not just trade but also higher investment flows from a particular country, which is undoubtedly true with most of its FTA-negotiating partners. In that case, two critical elements must be incorporated into its FTA policy. First, India should negotiate trade and investment as part of one comprehensive economic treaty. Decoupling trade from investment is not a good idea. Combining the two would give India a clear negotiating leverage to strike a beneficial deal. For example, India can argue that it needs more concessions in trade in return for offering something on investment or vice-versa. Second, India should consider expanding the scope of investment issues from mere facilitation to effective protection, with an efficacious dispute settlement mechanism under international law. Providing enforceable legal protection to foreign investors under international law will boost their confidence. This is critical at a time when foreign direct investment levels in India have dropped. A clear and comprehensive FTA policy is imperative for launching India to a higher economic growth trajectory.

The views expressed are personal

India -EFTA

- **India-European Free Trade Association signeda Trade and Economic Partnership Agreement (TEPA) today i.e. on 10th March 2024.**
- **India has been working on a Trade and Economic Partnership Agreement (TEPA) with EFTA countries comprising Switzerland, Iceland, Norway & Liechtenstein. The Union Cabinet chaired by the Hon'ble Prime Minister has approved signing of the TEPA with EFTA States. EFTA is an inter-governmental organization set up in 1960 for the promotion of free trade and economic integration for the benefit of its four Member State**

India and EFTA

- **EFTA is an important regional group, with several growing opportunities for enhancing international trade in goods and services.**
- **EFTA is one important economic block out of the three (other two - EU &UK) in Europe. Among EFTA countries, Switzerland is the largest trading partner of India followed by Norway.**
- **The highlights of the agreement are:**
  - **EFTA has committed to promote investments with the aim to increase the stock of foreign direct investments by USD 100 billion in India in the next 15 years, and to facilitate the generation of 1 million direct employment in India, through such investments. The investments do not cover foreign portfolio investment.**
  - **For the first ever time in the history of FTAs, a legal commitment is being made about promoting target-oriented investment and creation of jobs.**
  - **EFTA is offering 92.2% of its tariff lines which covers 99.6% of India's exports. The EFTA's market access offer covers 100% of non-agri products and tariff concession on Processed Agricultural Products (PAP).**
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- **India is offering 82.7% of its tariff lines which covers 95.3% of EFTA exports of which more than 80% import is Gold.**
- **The effective duty on Gold remains untouched.**
- **Sensitivity related to PLI in sectors such as pharma, medical devices & processed food etc. have been taken while extending offers. Sectors such as dairy, soya, coal and sensitive agricultural products are kept in exclusion list.**
- **India has offered 105 sub-sectors to the EFTA and secured commitments in 128 sub-sectors from Switzerland, 114 from Norway, 107 from Liechtenstein, and 110 from Iceland.**
- **TEPA would stimulate our services exports in sectors of our key strength / interest such as IT services, business services, personal, cultural, sporting and recreational services, other education services, audio-visual services etc.**
-

- **Services offers from EFTA include better access through digital delivery of Services (Mode 1), commercial presence (Mode 3) and improved commitments and certainty for entry and temporary stay of key personnel (Mode 4).**
- **TEPA has provisions for Mutual Recognition Agreements in Professional Services like nursing, chartered accountants, architects etc.**
- **Commitments related to Intellectual Property Rights in TEPA are at TRIPS level.**

What are the rules on contesting seats?

How many seats can a candidate contest? When were the guidelines amended?

Sreeparna Chakrabarty

The story so far:

When Congress leader Rahul Gandhi announced that he would contest from Rae Bareli in Uttar Pradesh, questions were raised on why he took the decision after the Kerala election was over – he is a contestant from Wayanad too. According to the Representation of the People Act (RPA), 1951, a candidate is permitted to contest an election from up to two constituencies, but he or she can hold only one seat at a time if elected from both.

Is there a cap?

A sub-section, 33 (7), of the RPA, allowing a candidate to contest from two seats, was introduced through an amendment in 1996, prior to which there was no bar on the number of constituencies from which a candidate could contest. However, Section 70 of the same Act stipulates that a candidate can hold only one seat at a time, regardless of whether he or she has been elected from more than one seat. Thus, if a candidate wins from two seats, a byelection is necessary from the seat he or she vacates. Former Chief Election Commissioner N. Gopalaswami said the opposition to a candidate contesting from many seats was basically due to the fact that many byelections had to be conducted after polls were over. Since then, the Election Commission of India and the Law Commission have both proposed that the RPA Act should be further amended to allow one person to contest from only one seat, given that a candidate cannot hold two seats at the same time. Mr. Gopalaswami said this was proving to be difficult as "no politician would like to reduce it to one from two, and laws are made by parliamentarians."

> The Election Commission of India and the Law Commission have both proposed that the Representation of the People Act should be further amended to allow one person to contest from only one seat

Moreover, a person has to be a voter in a particular State to contest Assembly polls from there. But to contest in a Lok Sabha election, a person can be registered as a voter in any constituency of the country. If a person is a registered voter in any constituency, he or she can contest from any seat in India, except Assam, Lakshadweep and Sikkim.

What is the minimum age to contest?

The minimum age for a person to contest Lok Sabha and Assembly polls is 25 years, while one can become a member of the Rajya Sabha or the State Legislative Council only at 30 years. There is no minimum educational qualification needed to contest general elections in India. Candidates must be citizens of India, registered in some constituency of the country as a valid voter and must not have been convicted of any offence punishable by more than two years.

How can a candidate be disqualified?

A person shall be disqualified from being chosen as or being a member of either House if he holds any office of profit under the Government of India or the Government of any State; if he or she is of unsound mind and stands so declared by a competent court; if he or she is an undischarged insolvent; if he or she is not a citizen of India or has voluntarily acquired the citizenship of a foreign state.

Under the RPA Act, if a person is convicted of any offence and sentenced to an imprisonment of two years or more, this will lead to his disqualification to contest elections. Even if this person is out on bail, after the conviction and his appeal is pending for disposal, he or she is disqualified from contesting an election. For some categories of serious offences, one may incur disqualification for any conviction, regardless of the quantum of punishment.

Over the years, what are some of the changes undertaken by the ECI regarding candidates?

The ECI has amended the rules for political party funding during elections. The new regulations include decreasing the cash donation limit from ₹20,000 to ₹2,000. The Electoral Bond Scheme, notified in January, 2018, allowing anonymous contributions to limit use of cash, was scrapped by the Supreme Court in 2024. For the 2024 polls, the ECI has banned cash transportation in bank vehicles after sunset. The Commission is also monitoring non-scheduled chartered flights for cash, liquor, and drug movement. ADR founder member Jagdeep Chokkar says there have been many interventions, but the desired effect has not come about as parties have found a way to circumvent it.

Mr. Gopalaswami points out that no law has been brought in with regard to muscle power of candidates. "That falls under criminal law which are enacted by politicians themselves," he says. But he adds that the presence of central paramilitary forces has been able to put a stop to practices like booth-capturing, a point strongly rebutted by Prof. Chokkar who says the "use of para-military forces is a shame in a democracy."

What are the rules on contesting seats?

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- However, Section 70 of the same Act stipulates that a candidate can hold only one seat at a time, regardless of whether he or she has been elected from more than one seat.
- Thus, if a candidate wins from two seats, a byelection is necessary from the seat he or she vacates.
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- **Mr. Gopalaswami said this was proving to be difficult as “no politician would like to reduce it to one from two, and laws are made by parliamentarians.**

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- The ECI has amended the rules for political party funding during elections.
- The new regulations include decreasing the cash donation limit from ₹20,000 to ₹2,000.
- The Electoral Bond Scheme, noti□ed in January, 2018, allowing anonymous contributions to limit use of cash, was scrapped by the Supreme Court in 2024. For the 2024 polls, the ECI has banned cash transportation in bank vehicles after sunset.
- The Commission is also monitoring non-scheduled chartered □ights for cash, liquor, and drug movement

Will cattle be the next lab for flu host-switching?

The co-expression of both human and avian receptors in the mammary glands of cows indicate susceptibility to viruses of both swine/human and avian origin

R. Prasad

Cattle have so far not been associated with being infected on large-scale, and as a result, cattle have not been well studied as domestic hosts for influenza A virus species. In contrast to the notion that cattle are considered to be almost resistant to infection with influenza A virus, H5N1 virus, which was first detected in dairy cattle in Texas in late March, has rapidly spread to 37 herds in nine States in the U.S. as of May 7.

On April 24, the U.S. FDA said that in a nationally representative commercial milk sampling study of pasteurised milk, about one in five of the retail samples tested positive for bird flu viral fragments. A greater proportion of positive results were in milk from areas with infected herds. An NIH-funded study had found an absence of infectious virus in milk samples. The April 23 report of the FAO noted that the H5N1 virus was detected in "high concentrations in milk from infected dairy cattle and at levels greater than that seen in respiratory samples". That the concentration was less in the respiratory samples of the infected cows compared with the milk samples strongly suggests that the pathogenesis of the H5N1 virus in cattle differs from other mammals, says a study posted as a preprint; preprints are yet to be peer-reviewed.

Crucibles for reassortment of influenza virus genes

Reassortment is the process by which influenza viruses swap gene segments when two differing influenza viruses co-infect a cell

RAPID SPREAD: As of May 7, H5N1 virus has spread to 37 herds in nine States in the U.S.

- H5N1 virus has been detected in high concentrations in milk from infected dairy cattle and at levels greater than that seen in respiratory samples
- Higher concentration of virus in milk samples compared with respiratory samples strongly suggest that H5N1 pathogenesis in cattle differs from other mammals
- Influenza virus has greater propensity to infect the mammary glands of cows
- Both human and duck receptors are highly expressed in the mammary glands of cows
- The presence of human and duck receptors in the mammary glands provides an opportunity for the evolution of H5N1 viruses to easily spread animals to humans
- Pigs are called the 'evolutionary lab for flu host switching' due to the presence of human-flu and avian-flu host cell receptors in the respiratory tract
- Reassortment might help the avian flu virus to become better adapted to bind to human receptors and spread from birds to humans more easily

One reason for dairy cattle milk containing high concentrations of H5N1 virus fragments could be the propensity of the virus to infect the mammary glands of cows as a previous study had found. On evaluating the expression of H5N1 receptors in the mammary gland, respiratory tract and cerebrum of cattle, the authors found both the human and the duck receptors to be highly expressed in the mammary glands. In the mammary gland, the human receptors and the duck receptors were found to be widely distributed in the alveoli. Chicken-type influenza receptors were common in the cow respiratory tract. The high concentration of H5N1 virus fragments in milk from H5N1-infected cows could be due to local viral replication in the mammary glands of cows as H5N1 has a high affinity for the receptor, the authors say.

The study found that the chicken receptor was expressed on the surface of the respiratory epithelium in the upper respiratory tract and upper part of the lower respiratory tract, while human and duck receptors were either lacking or very limited in expression. However, in the lung alveolar epithelium, both receptors of humans, chickens and ducks being abundantly expressed.

The abundance of human and duck receptors in the mammary glands and the large presence of human, chicken and duck receptors in the lung alveolar cells of cows provides a perfect environment for the evolution of H5N1 viruses that can easily spread from animals to humans. The reason why pigs are called the "evolutionary lab for flu host switching" is precisely due to the presence of both the human-flu and avian-flu host cell receptors in their upper-respiratory tract, says Dr. Sam Scarpino from Northeastern University in a tweet. The latest study has found that cow mammary glands contain the same kind of mixed flu receptors seen in pigs.

"One of the key changes required for avian flu to transmit effectively in humans involves flu's hemagglutinin (HA) host cell receptor preference," Dr. Scarpino said in another tweet. "Currently the cell surface receptor that influenza uses in birds is subtly different from the one in the human upper-respiratory tract". But when pigs get infected with human and avian influenza viruses at the same time, the viruses can potentially undergo reassortment, wherein small segments of their genomes get swapped. The swapping might sometimes help the avian flu viruses to become better adapted to bind to human receptors and hence spread from birds to humans more easily. The H1N1 pandemic of 2009 was due to the reassortment of the virus in pig populations.

"The co-expression of both human and avian receptors in the mammary glands indicate susceptibility to viruses of both swine/human and avian origin. The co-expression of both receptors can make bovines to behave like a mixing vessel for new influenza A virus with increased zoonotic potential, the authors write.

With the mammary glands of cows harbouring receptors for both human-flu and avian-flu, "dairy cattle may have similar potential as pigs to serve as evolutionary intermediaries between avian and human flu".

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The magpies of the Himalayas

SPEAKING OF SCIENCE

D. Balasubramanian

Magpies belong to the Corvidae family of birds that includes crows, jays and ravens. Birds of this family are generally considered to be noisy, inquisitive birds that in folklore from around the world have often been associated with omens, good or bad. In some European cultures, they accompany witches. An English rhyme, "One for sorrow, two for joy; three for a girl, four for a boy; Five for silver, six for gold; Seven for a secret never to be told," suggests that spotting a lone magpie brings bad news. But no one will deny that the magpies are striking in appearance, or that some of the most flamboyant species are found in the Himalayas.

From Kashmir to Myanmar, a few closely related blue magpie species are a common sight. The gold-billed magpie, *Urocissa flavirostris*, also called the yellow-billed blue magpie, has mischief in its eyes and occupies the high altitude zone between 2000 and 3000 meters above sea level. At slightly lower heights we find the red-billed magpie, and the blue magpie is found at lower altitudes where humans live in larger numbers.

Trekking corridors

Best sightings of the yellow and red-billed varieties are in the trekking corridor in Western Sikkim that leads from the town of Yuksom, at 1,780 metres above sea level, to fabulous sights of the Kanchenjunga from near the Goche La pass at about 4,700 metres above sea level. The journey takes you from tropical moist broad-leaf forests at the lower altitudes through high sub-Alpine forests to a treeless Alpine landscape of juniper bushes. Somewhere in the middle are forests whose canopies close in over you, and an astonishing diversity and density of birds.

High above: Gold-billed magpies occupy the high altitude zone between 2,000 and 3,000 meters above sea level. GETTY IMAGES

Field studies by zoologists at the Sikkim Government College have documented that over 250 species of birds are found in this zone, and at around 2,500 metres above sea level, you can see or hear nearly 60 individual birds in a five-minute time interval. The yellow-billed blue magpie is very often a part of this chorus. The body of the bird is about the size of a pigeon, but with a 45-centimeter-long tail, adding up to an overall size of 66 cm. While foraging for worms on the ground, the tail is pointed upward; while picking berries in trees, the tail swoops downward. The flight is characteristic too: a few quick wing beats, followed by long gliding movements.

The yellow-billed blue magpie builds its nests at the forks of branches in rhododendron trees. The nest itself appears to be a hurried job of twigs, with a soft lining of grass in which three-six eggs are laid in May or June. Both parents take part in raising the young. As the nursery rhyme says, two for joy.

The blue magpie and the red-billed magpie are very similar in appearance too, though a little smaller. The blue magpie is less of a forest bird, and more often seen around villages. All the species can be spotted as solitary birds, in pairs, or noisy flocks of 8-10 birds.

As human presence in forests increases, there are worries about how well the birds can cope. The colorful flowers of rhododendrons attract tourists. To support tourists, villagers often resort to forest resources such as firewood. It is hoped that just like agriculture, tourism will also learn to be a sustainable trade.

(The article was written in collaboration with Sushil Chandani, who works in molecular modelling)

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Question Corner

Strange trigger

Can heavy snowfall and rain contribute to some earthquakes?

A recent study has found that episodes of heavy snowfall and rain likely contributed to a swarm of earthquakes over the past several years in northern Japan. This is the first time that climate conditions have been found to initiate some quakes. The seismic activity in the region was surprisingly found to synchronise with certain changes in underground pressure, and those changes were influenced by seasonal patterns of snowfall and precipitation. Scientists suspect that this new connection between quakes and climate may not be unique to Japan. Since late 2020, hundreds of small earthquakes – earthquake swarms – have shaken up Japan's Noto Peninsula, in 2020 changes in seismic velocity appeared to be synchronised with the seasons. When it rains or snows, that adds weight, which increases pore pressure, which allows seismic waves to travel through slower. When the seismic velocity observations and the model of excess pore pressure were overlapped, they fit extremely well.

Readers may send their questions / answers to questioncorner@thehindu.co.in

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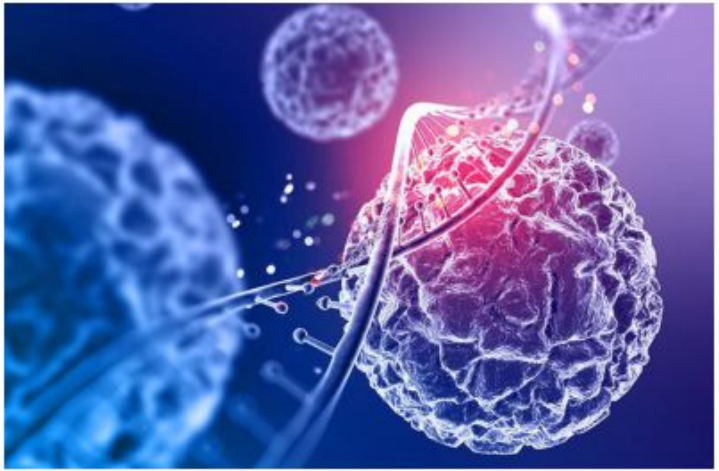


Early clinical trial sheds light on regulatory T cell therapies

Results from a new clinical trial shed light on the performance of infusions of immune-calming regulatory T cells for children with type 1 diabetes. The trial shows that a single dose of the cells can transfer over efficiently in children but does not show signs of preserving insulin-releasing cells in the pancreas, highlighting the need for further research. Researchers have theorized that supporting regulatory T cell activity – or even infusing these cells – could treat autoimmune disorders.

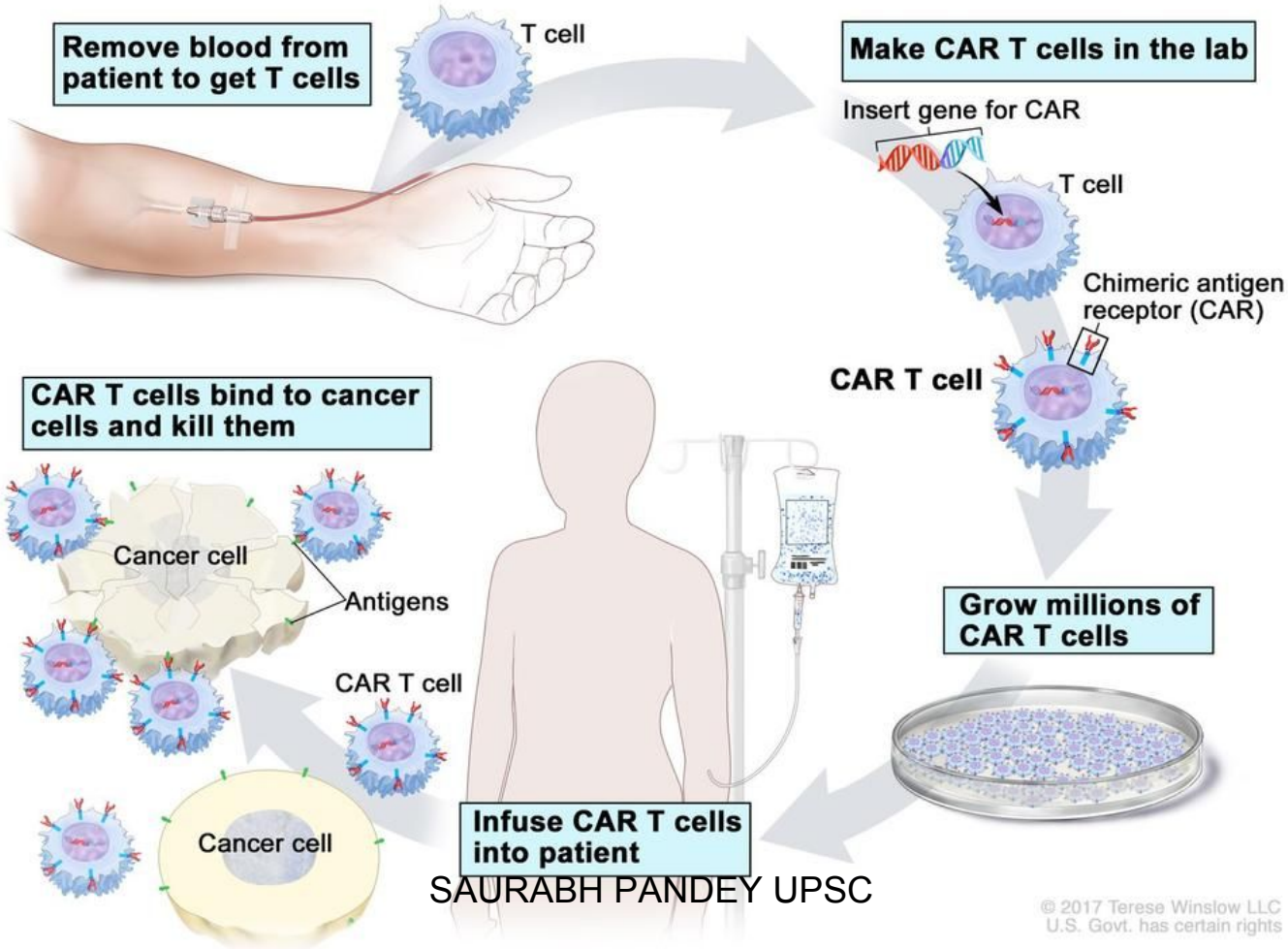
CAR T-cell therapy is a type of treatment in which a patient's T cells (a type of immune cell) are changed in the laboratory so they will bind to cancer cells and kill them.

TIL THERAPY

- TIL therapy uses T cells called tumor-infiltrating lymphocytes that are found in your tumor. Doctors test these lymphocytes in the lab to find out which ones best recognize your tumor cells.
- Then, these selected lymphocytes are treated with substances that make them grow to large numbers quickly.
- The idea behind this approach is that the lymphocytes that are in or near the tumor have already shown the ability to recognize your tumor cells.

- **But there may not be enough of them to kill the tumor or to overcome the signals that the tumor is releasing to suppress the immune system.**
- **Giving you large numbers of the lymphocytes that react best with the tumor can help to overcome these barriers.**

CAR T-cell Therapy



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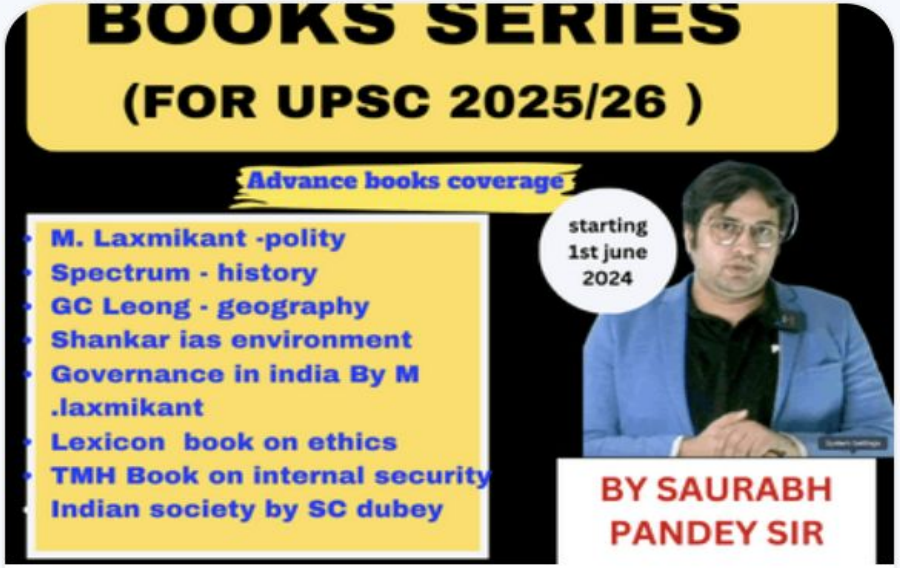

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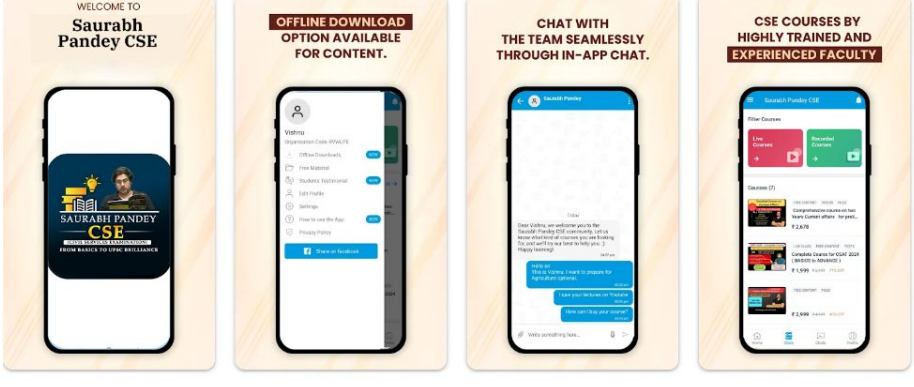

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