# Topics

- **Lion-tailed macaques**
- **Critical Priority Pathogens**
- **Synuclein alpha (SNCA)'**
- **Stellar nucleosynthesis**
- **Generalized System of Preferences (GSP)**
- **Segara Kerthi,**
- **Human papillomavirus (HPV)**
- **The sea otter**
- **Tomography**
- **Mains**

**By saurabh Pandey**

THE HINDU

# Target Mains -2024/25

Q ''Endemism of wild species depends on various factors '' Explain

प्रश्न "जंगली प्रजातियों की स्थानिकता विभिन्न कारकों पर निर्भर करती है" स्पष्ट करें

# Connect with sir 9057921649

# The hindu session pdf

**Download the hindu session pdf**

**Telegram link in description box**

**Download the hindu pdf - https://t.me/gesreporter**

# अनुत्तरदायी एवं अनैतिक AI समाज के लिए अभिशाप

## प्रस्तावना :-

डिजिटलीकरण के उपयोग के पश्चात विश्व ने अपनी एक नई पहचान बनाई तो वहीं 21वीं सदी में तकनीकी के विकास ने विज्ञान एवं प्रौद्योगिकी के क्षेत्र में अपना अमूल्य योगदान दिया।

वैज्ञानिकों के लगातार शोध के कारण मानव ने अपने मस्तिष्क के विकास के साथ-साथ वैज्ञानिक क्षेत्र में अकल्पनीय अविष्कार करने प्रारंभ किये ताकि मानव जीवन की गुणवत्ता में और सुधार कर अपनी जीवन शैली को और बेहतर कर सके।

इन बेहतर अविष्कार में एक महत्व कृत्रिम बुद्धिमत्ता रही, जिसने मानव के सम्मुख उसी के समान उसकी प्रति बनाने का प्रयत्न किया ताकि वह मानव जीवन को और सुगमता प्रदान कर सके।

तकनीकी का सदुपयोग आविष्कार, वहीं उसका दुरुपयोग अभिशाप के समान।

## कृत्रिम बुद्धिमत्ता :-

कृत्रिम बुद्धिमत्ता एक ऐसी युक्ति जो मानव द्वारा निर्धारित सूचनाओं, डेटा का प्रयोग कर अपने सुझाव के साथ प्रिडिक्ट भी करता है यह भिन्न क्षेत्रों में कार्य करता है। वर्तमान में यह सर्वव्यापी हो गया है कृत्रिम बुद्धिमत्ता की सहायता से अलग-अलग क्षेत्रों की दक्षता में वृद्धि होती है।

यह machine learning, Natural language Processing तथा Predictive Analytics का उपयोग कर स्वयं को संचालित करता है।

## कृत्रिम बुद्धिमत्ता का प्रयोग :-

सामान्यत: अधिकतर धनेक में AI का उपयोग किया जा सकता है उनमें से कुछ चुनिंदा विषय नीचे प्रकट किये गये है -

### न्यायपालिका की मदद -

न्यायालय में अपने पूर्व आदेशों की समीक्षा तथा उनके साथ वर्तमान परिदृश्य को जोड़कर एक गहरा फैसला सुनाने में AI का प्रयोग किया जा सकता है।

- AI की मदद से लंबित पेंडिंग केस को प्राथमिकता दी जा सकती है। उन्हें पहले ट्राइल के लिए न्यायालय के सम्मुख प्रस्तुत किया जा सकता है।

- E filiing तथा virtual Healing के माध्यम से भी कोर्ट पर भार को कम करने में AI महत्वपूर्ण भूमिका निभा सकता है जिसके लिए IIT Delhi के शोधकर्ता ने "DAKSH" बनाया

- इसके प्रयोग से Under thial, Prisoner की संख्या में कमी होगी।

## अवस्थापिका में मदद :-

इसके प्रयोग से शोध क्षमता में सुधार, किसी बिल का पूर्वविलोकन करने के लिए जनता के विचार जानने में, उसे उन सभी भूल्यों पर परखकर जो समाज के लिए आवश्यक है।

जिस भांति मानव में अनेक सकारात्मकता निवास करती है एवं उसके साथ ही कुछ नकारात्मकता भी भर जाती है ठीक उसी प्रकार कृत्रिम बुद्धिमत्ता के भी सकारात्मक के साथ कुछ नकारात्मक परिणाम भी हैं।

## कृत्रिम बुद्धिमत्ता की नकारात्मकता :

### मानव केन्द्रीय Approach

— चूकि कृत्रिम बुद्धिमत्ता में Fid डेटा मानव के द्वारा ही होता है तो यह स्पष्ट है कि मानव के सकारात्मक एवं नकारात्मक विचार का प्रभाव कहीं न कहीं उस डेटा पर पड़ता ही है, कई बार यह इतना एक- पथगामी ही जाता है कि उसे अन्य dimension दिखते ही नहीं, यही कारण है कि AI उसके नकारात्मक पक्षों पर विचार नहीं कर पाता, जो आदेश मनुष्य द्वारा निर्देशित है वह उसे पूरा करेगा उसके प्रभावों से उसे कोई मतलब नहीं।

### अनुत्तरदायी कृत्रिम बुद्धिमत्ता —

अनुत्तरदायी अर्थात जिसके परिणाम के लिए कोई उत्तरदायी न हो।

कृत्रिम बुद्धिमत्ता भविष्य में यदि कोई अपराध अथवा मानवीय मूल्यों, कानून का उल्लंघन करता है तो उसका उत्तरदायित्व कौन लेगा?

क्या जिस व्यक्ति ने उसका निर्माण किया, उसमें Data को फीड किया वो उत्तरदायी होगा या फिर वह मशीन उत्तरदायी होगी जिसके द्वारा कार्य संपादित हुआ है।

---

कृत्रिम बुद्धिमत्ता से उत्पन्न परिणाम व्यक्ति के ऊपर निर्भर तो वह व्यक्ति गलत सूचनाएं प्रदान कर विषय से भटकाने का भी प्रयत्न कर सकता है। Deepfake ऐसी तकनीक का प्रयोग कर मानव के मानवीय मूल्यों को आघात पहुँचाने का प्रयत्न कर सकता है जिसे मानव Ethical Right का उल्लंघन होगा।

### अनैतिक कृत्रिम बुद्धिमत्ता —

चूकि यह एक तकनीक है तो इससे अपेक्षा नहीं की जा सकती कि यह व्यक्ति के मानवीय मूल्यों सत्य, दया, करुणा, परोपकार, अहिंसा कर्तव्य का आदर करेगा।

इसके लिए आवश्यक होगा कि इसके उद्गम का स्रोत में ये अवधारणाएं निहित हो।

मनुष्य जहां —

सर्वे भवन्तु सुखिन: सर्वे सन्तु निरामया।
सर्वे भद्राणि पश्यन्तु मा कश्चिद् दुख भागभवेत्॥

— की अवधारणा से अपना जीवन व्यापन करता है वहीं AI स्वार्थी जीवन की ओर मानव को अग्रसर करेगा।

### समाज :

जहाँ मनुष्य मानवीय सिद्धान्त के आधार पर एक दूसरे से अन्तर्गहित होकर सहचर्यी पूर्ण क्रियाओं के आधार पर अपनी गतिविधियों को संचालित करता है तो वह ऐसे समूह में आबद्ध हो जाता है जिसे समाज कहते हैं।

### समाज में AI की भूमिका :

— चूकि कृत्रिम बुद्धिमत्ता का निर्माण भी इसी समाज में निहित व्यक्तियों द्वारा, समाज के

उत्थान के लिए ही किया गया है तो उसके सकारात्मक एवं नकारात्मक प्रभाव भी इसी समाज पर ही प्रत्यक्ष अथवा अप्रत्यक्ष प्रभाव डालते हैं तो पूर्ण रूप से यह कहना कि कृत्रिम बुद्धिमत्ता समाज के लिए अभिशाप है उचित नहीं होगा क्योंकि समाज में उसका सकारात्मक प्रभाव भी स्पष्ट होता है।

महात्मा गांधी के अनुसार
" मेरी आपत्ति मशीनों के प्रति सनक से है यह सनक श्रम बचाने वाली मशीनों के लिए है यह तब तक श्रम बचाते रहेंगे जब तक हजारों लोग भूख व काम से सड़क पर न फेंक दिये जायें, मैं सभी के लिए समय व श्रम बचाना चाहता हूँ । "
यंग इण्डिया    13 Nov 1924

उपसंहार :-
हमें इन नकारात्मक प्रभावों को कम करने का प्रयत्न करना चाहिए ताकि हम उसके सकारात्मक पक्षी को ज्यादा उभार सकें उसके लिए उत्तरदायित्व के सिद्धांत का पालन करते हुए कृत्रिम बुद्धिमत्ता में मानवीय नैतिक मूल्यों को निहित करना ज्यादा उचित रहेगा, यदि यह कुछ गलत हाथों में पड़ता भी है तो शीघ्र अतिशीघ्र उसका पता लगाकर, लोगों को संकट से बचाना, लोगों को अत्यधिक जागरूक बनाना ताकि वे भी भविष्य में आने वाले संकट को भांप सकें, हम उसके प्रभाव को रोक नहीं सकते परन्तु हम उससे लड़ने के लिए अपने आप को मजबूती से तैयार कर सकते हैं।
—:0:—

# With food scarce, lion-tailed macaques leave forest canopies for the urban jungle

**Wilson Thomas**
COIMBATORE

At 6 a.m., Valparai town in Coimbatore district of Tamil Nadu is a typical hill station with roads largely free of vehicles and people. But there is a bustle of activity near the Sree Muruga temple in the heart of the town. Monkeys with silver-white manes contrasting with shiny coats of black fur and tufted tails have parked themselves on the roofs of buildings, railings and platforms of shops. They are busy looking for something to eat, even food waste or rotten fruits and vegetables. Some look for bits and pieces of biscuits and chips in discarded packets.

While the town comes alive with the arrival of morning buses and tourist vehicles around 7 a.m., the monkeys cross the road, clinging to television cables, to go behind a temple, before eventually heading to their natural habitat at Puthuthottam, around four km from the town.

This is a glimpse of how the lion-tailed macaque (*Macaca silenus*), an arboreal primate endemic to select rainforests of the Western Ghats, are forced to rummage through urban waste and grab food from houses, while they are supposed to be a shy and largely frugivorous primate that prefer upper canopies of rainforests.

"Six-seven years ago, one wouldn't see these monkeys near Valparai town. Now they are regular visitors and rummage through waste dumped in parts of the town. They also raid workers' quarters and houses for food just as the common monkeys [bonnet macaques] do," says Valparai resident S.P. Murugaiyya.

The Valparai plateau, known for vast swathes of tea and coffee estates interspersed with forest patches that fall under the Anamalai Tiger Reserve, is one of the 40-odd populations of the lion-tailed macaque in the Western Ghats, spread across Tamil Nadu, Kerala, and Karnataka.

The lion-tailed macaque was reassessed and classified as an 'endangered' species in the IUCN Red List in 2020, with about 2,500 mature individuals distributed in the Western Ghats hill ranges between the Kalakkad Hills in the south and Sirsi-Honnavara in the north. The Wildlife (Protection) Act, 1972 gives it the highest conservation priority by listing it under Schedule-I.

Biologists say their current numbers in the wild could range between 3,000 and 3,500. The Valparai plateau is believed to have around 500, making it one of the important populations.

Honnavalli N. Kumara, Principal Scientist at the Salim Ali Centre for Ornithology and Natural History, who has been studying them for over two decades, says the population at Puthuthottam is at the top of the entire population of the very shy primate in terms of the behavioural change.

"In 1996, there was only one group of 32 individuals at Puthuthottam. The population increased and two groups were formed in 1998. Now there are five groups comprising a little over 200 individuals, of which one group is entering Valparai town while another group has got accustomed to human habitations at Rottikadai. A separate group has now started appearing at Iyerpadi on the Pollachi-Valparai road," Dr. Kumara says.

## Lack of food

Wildlife biologist Ashni Kumar Dhawale, who studied the groups at Puthuthottam for several years, says the lack of natural food such as fruits throughout the year in their habitats has also pushed the primates to look for alternatives. Most of the fruits in their diet are seasonal.

The Agumbe ghat section in Shivamogga district in Karnataka, Vellimalai in Theni district in Tamil Nadu and Nelliyampathy in Kerala are among the places where they are observed to have lost fear for humans and exhibiting similar behavioural trends, reasons for which include habitat degradation, roads passing through their habitats, increased vehicular movement, food offered by tourists and improper waste management.

"When easily available food in clumped distribution is available, they tend to prefer them. This attracts them to human settlements and then to town," Dr. Dhawale says.

P.S. Easa, former Director of the Kerala Forest Research Institute and Chairman of the Care Earth Trust, feels roads passing through LTM habitats, which cut off canopy connectivity, force them to come down to the roads to pass to the other side. During the process, people provide them with food and slowly they get accustomed to human food.

"At Nelliyampathy, road widening has cut off canopy connectivity for lion-tailed macaques, an endangered species considered to be almost cent per cent arboreal. They come to the road and wait for people, expecting food. But they have not moved to the town as in Valparai," says Dr. Easa, who wanted authorities to address the worrying trend.

## Canopy corridors

At the Agumbe ghats, the Karnataka Forest Department has tasked frontline staff with preventing people from feeding them and driving out those monkeys that come to the road. In Valparai, Tamil Nadu Forest Department staff and persons appointed by the Nature Conservation Foundation are taking similar steps and aiding them to cross the road safely. The NCF has also established canopy corridors across roads that pass through their habitats and is planning to add more.

"This trend is worrying and requires immediate management plans as groups in other populations might also start losing fear and come to roads and human settlements. There can be an increase in roadkill and people's attitude towards them might also change when they start stealing food and causing nuisance," Dr. Kumara says.

By a Tamil Nadu Forest Department estimation, more than 15 lion-tailed macaques were killed in vehicle hits and by electrocution in the past 20 years.

Dr. Dhawale says road accidents claimed three lion-tailed macaques on the Valparai plateau in the past month alone.

"As per studies, the mortality rate of lion-tailed macaques at Puthuthottam is more than 5%," says Dr. Dhawale, who also wanted local bodies to give more focus on waste management, so that endangered animals do not scavenge waste.

Tamil Nadu, in its State Budget this year, announced it will establish a Tamil Nadu Endangered Species Conservation Fund with a corpus of ₹50 crore. The lion-tailed macaque is one of the species to be covered under the fund.

Supriya Sahu, Additional Chief Secretary, Environment, Climate Change and Forest, said the Tamil Nadu Forest Department will take up a study on the lion-tailed macaque. "We will also try and see if we can do the population estimation and then decide the conservation strategy," she said.

The ATR administration, under the leadership of Field Director S. Ramasubramanian, has also sent a proposal to the Forest Department to conduct a study, by roping in experts.



**New pastures:** A group of lion-tailed macaques resting on the roof of a building at Valparai in Coimbatore, Tamil Nadu. M. PERIASAMY

# Lion-tailed macaques

## Geographic Range

Lion-tailed macaques (*Macaca silenus*) are found only in India in the Western Ghats mountains.

## Habitat

Macaca silenus lives in evergreen and semi-evergreen rainforests and monsoon forests.

They typically are associated with broadleaf trees, and can be found at elevations as great as 1,500 m.

- **This species is polygynous. Groups of M. silenus typically contain one male and several females and juveniles.**
- **Lion-tailed macaques are arboreal and diurnal.**
- **Lion-tailed macaques are the only macaques in which males use calls to advertise their territorial boundaries**
- **Male macaques are territorial and generally give off a loud call to let entering troops know they are in the area.**

- Macaques have extensive patterns of communication, typical of diurnal primates. They rely heavily on vocal communication.
-  "Lion-tailed macaques have 17 different vocal patterns and many types of body movements used to express communication
- Lion-tailed macaques are omnivorous but their diet consists mainly of fruit.
- They also eat a wide variety of vegetation such as leaves, stems, flowers, buds, and fungi.
- They occasionally eat meat from insects, lizards, tree frogs, and small mammals

**Because of their frugivory and their ability to carry fruits in their large cheek pouches, it is likely that these monkeys play some role in seed dispersal.**

**IUCN Red List** ➡
Endangered
**More information** ➡

**IUCN Red List** ➡
Endangered
**More information** ➡

**US Federal List** ➡
Endangered No special status

**CITES** ➡
Appendix I

**Contributors**

# Critical priority pathogens continue to pose threat: WHO

**Bindu Shajan Perappadan**
NEW DELHI

Critical priority pathogens present major global threats due to their high burden, and ability to resist treatment and spread resistance to other bacteria, noted the latest Bacterial Pathogens Priority List (BPPL) updated by the World Health Organization (WHO). This includes gram-negative bacteria resistant to last-resort antibiotics, and *Mycobacterium tuberculosis* resistant to the antibiotic Rifampicin. The list features 15 families of antibiotic-resistant bacteria grouped into critical, high, and medium categories for prioritisation.

Seven years since it published the last such list, the WHO stated that high-priority pathogens, including salmonella and shigella, are of particularly high burden in low- and middle-income countries, along with *Pseudomonas aeruginosa* and *Staphylococcus aureus*, which pose significant challenges in healthcare settings. Antimicrobial Resistance (AMR) occurs when bacteria, viruses, fungi, and parasites no longer respond to medicines, increasing the risk of disease spread, illness and deaths. "AMR is driven in large part by the misuse and overuse of antimicrobials," the document says.

Other high-priority pathogens such as antibiotic-resistant *Neisseria gonorrhoeae* and *Enterococcus faecium*, present unique public health challenges, including persistent infections and resistance to multiple antibiotics, necessitating targeted research and public health interventions.

"By mapping the global burden of drug-resistant bacteria and assessing their impact on public health, this list is key to guiding investment and for grappling with the antibiotics pipeline and access crisis. Since the first Bacterial Priority Pathogens List was released in 2017, the threat of antimicrobial resistance has intensified, eroding the efficacy of numerous antibiotics and putting many of the gains of modern medicine at risk," Yukiko Nakatani, the WHO's Assistant Director-General for Antimicrobial Resistance *ad interim*, said.

# Critical Priority Pathogens

- **Critical priority pathogens present major global threats due to their high burden, and ability to resist treatment and spread resistance to other bacteria, noted the latest Bacterial Pathogens Priority List (BPPL) updated by the World Health Organization (WHO).**

- **This includes gram-negative bacteria resistant to last-resort antibiotics, and Mycobacterium tuberculosis resistant to the antibiotic Rifampicin.**

- **The list features 15 families of antibiotic-resistant bacteria grouped into critical, high, and medium categories for prioritisation**

- **WHO stated that high priority pathogens, including salmonella and shigella, are of particularly high burden in low- and middle income countries, along with Pseudomonas aeruginosa and Staphylococcus aureus, which pose significant challenges in healthcare settings.**
- **Antimicrobial Resistance (AMR) occurs when bacteria, viruses, fungi, and parasites no longer respond to medicines, increasing the risk of disease spread, illness and deaths.**

- "AMR is driven in large part by the misuse and overuse of antimicrobials,".
- Other high-priority pathogens such as antibiotic-resistant Neisseria gonorrhoeae and Enterococcus faecium, present unique public health challenges, including persistent infections and resistance to multiple antibiotics, necessitating targeted research and public health interventions

# Balancing two forms of SNCA protein could help manage Parkinson's

Today, Parkinson's is treated symptomatically by increasing the levels of dopamine or, more drastically, by grafting new neurons in place of dead ones. A solution based on the SNCA protein is more desirable because it will offer a more sustainable resolution

**Somdatta Karak**



A protein called synuclein alpha is notorious for its involvement in age-related neurodegenerative diseases. GETTY IMAGES/ISTOCKPHOTO

Synuclein alpha (SNCA) is a mysterious protein. It's present in healthy cells but we don't know what it does there. It is notorious for its involvement in age-related neurodegenerative diseases. Twenty-seven years ago, researchers first associated SNCA with Parkinson's disease. People with this disease lose neurons that communicate with each other using dopamine as a neurotransmitter in a part of their brains.

These dopaminergic neurons have been found to contain aggregated masses of proteins called Lewy bodies. Most of these proteins are SNCA.

Since then, researchers have reported SNCA in similar aggregates in the brains of people with other neurodegenerative diseases as well. But its presence is most prominent in brains with Parkinson's.

SNCA is abundant in neurons, especially in dopaminergic neurons. It is found near the nuclei of these cells and at the junctions between two neurons. It's capable of misfolding as well as forming filamentous structures. So unlike most other proteins, which take up predictable three-dimensional structures, SNCA can fold in multiple ways. Misfolded proteins don't function correctly.

But beyond these observations, researchers don't understand the dynamics of the formation of these aggregates and how exactly they affect neurons.

**Two populations**

A recent study from Swasti Raychaudhuri's lab at the CSIR-Centre for Cellular and Molecular Biology, Hyderabad, published in the *Journal of Cell Science*, reported two ways in which SNCA is present as aggregates in cells: one that interferes with the structural integrity of cells' nuclei and another that allows the cell to degrade misfolded proteins. The researchers found that the former are related to diseased states while the latter is important for healthy cells.

As such, the study highlights the importance of striking a balance between these two SNCA populations to manage Parkinson's disease.

The researchers cultivated neurons outside a living body, providing them with nutrients in a laboratory setup. In these neurons, they artificially created structures resembling Lewy bodies by adding some amount of misfolded SNCA, called seeds.

Over time, they found two SNCA populations in the cells: one was around the nuclei, shaped like filaments tens of micrometres long, much like Lewy bodies. The other population was also around the nuclei but as much smaller clumps called aggresomes. Such aggresomes are formed when cells localise misfolded proteins into a small bunch (like collecting the trash in a corner) for further processing.

**Breaching the nucleus**

They noticed that the Lewy-body-like structures formed very slowly. Most of the time, the aggresomes took up the SNCA proteins and didn't allow the Lewy-body-like structures to grow. But in their experiment, when the researchers repeatedly seeded neurons with misfolded SNCA, the Lewy-body-like structures formed faster and became big enough to affect other parts of the cell. At one point, they became too populous for the aggresomes to mitigate their prevalence.

The enlarged Lewy-body-like structures were situated at the periphery of the nuclei of the cells, and the researchers have argued that this damages the nuclear envelope. Sometimes, the structures also entered the ruptured nucleus.

A nucleus is the control centre of the cell. It contains the cell's genetic material, and is the seat of upkeep of this genetic material and its utilisation to make proteins. So it is logical that the accumulation of misfolded SNCA would render the nucleus dysfunctional and eventually kill it. In addition, Lewy-body-like structures can pass from one cell to another, so the effect could cascade to neighbouring cells as well.

> Twenty-seven years ago, researchers first associated SNCA with Parkinson's disease. People with this disease lose neurons that communicate with each other using dopamine as a neurotransmitter in their brains

Dr. Raychaudhuri's team was able to cross-check its findings in mice with Lewy-body-like structures in their brains. They reported that the increasing prevalence of these structures induced conditions mimicking Parkinson's disease. They also found that all the cells so affected also had damaged nuclear envelopes.

**A therapeutic target?**

Many Parkinson's disease researchers are focused on reducing the prevalence of SNCA in neurons as a therapeutic measure. Researchers are going about this in various ways, but haven't yet found one that has been approved for sale.

One way is to reduce the cells' SNCA content. A smaller population of SNCA means fewer misfolded SNCA, too. Researchers have achieved this by stopping the SNCA gene from expressing itself or by destroying the SNCA protein inside cells, once the cells make them. However, either of these interventions needs to happen only in select locations: if all the SNCA everywhere is taken away, the animal body will die.

Another workable solution has been to use a gene-silencing tool, like CRISPR-Cas9, at a precise location. Researchers have tried this method in cell cultures and model animals. But a significant challenge is to cross the blood-brain barrier, a liquid that filters the blood that goes into the brain, and which would also prevent a component CRISPR from passing through.

To surmount this barrier, some researchers have tried to inject molecules that inhibit the SNCA gene through the skull, directly into the desired brain region. Others have used small molecules like modified viruses to beat the barrier. Some researchers have also identified enzymes that degrade proteins in select brain cells, but with varying efficacy.

Another possibility is to stop SNCA from forming large aggregates. Dr. Raychaudhuri has suggested balancing the SNCA population between aggresomes and Lewy bodies. The more SNCA that goes into the aggresomes, the less there will be available to make Lewy bodies. How this can be achieved is still being worked out.

Even if any one of these methods succeeds, it will transform the way Parkinson's disease is treated today. Today, Parkinson's is treated symptomatically by increasing the levels of dopamine or, more drastically, by grafting new neurons in place of dead ones. An SNCA-based solution is more desirable because it offers a more sustainable resolution.

*(Somdatta Karak, PhD, heads science communication and public outreach at CSIR-Centre for Cellular and Molecular Biology.)*

## THE GIST

▼ SNCA is abundant in neurons, especially in dopaminergic neurons. It is found near the nuclei of these cells and at the junctions between two neurons. It's capable of misfolding as well as forming filamentous structures. Misfolded proteins don't function correctly

▼ A study reported two ways in which SNCA is present: one that interferes with the integrity of cells' nuclei and another that allows the cell to degrade misfolded proteins. The former are related to diseased states while the latter is important for healthy cells

▼ A smaller population of SNCA means fewer misfolded SNCA. Researchers achieved this by stopping the SNCA gene from expressing itself or by destroying the SNCA inside cells. Either of these interventions needs to happen only in select locations: if all the SNCA is taken away, the body will die

# Synuclein alpha (SNCA)

- S ynuclein alpha (SNCA) is a mysterious protein. It's present in healthy cells but we don't know what it does there.

- It is notorious for its involvement in age-related neurodegenerative diseases.

- Twenty-seven years ago, researchers ☐first associated SNCA with Parkinson's disease.

- People with this disease lose neurons that communicate with each other using dopamine as a neurotransmitter in a part of their brains.
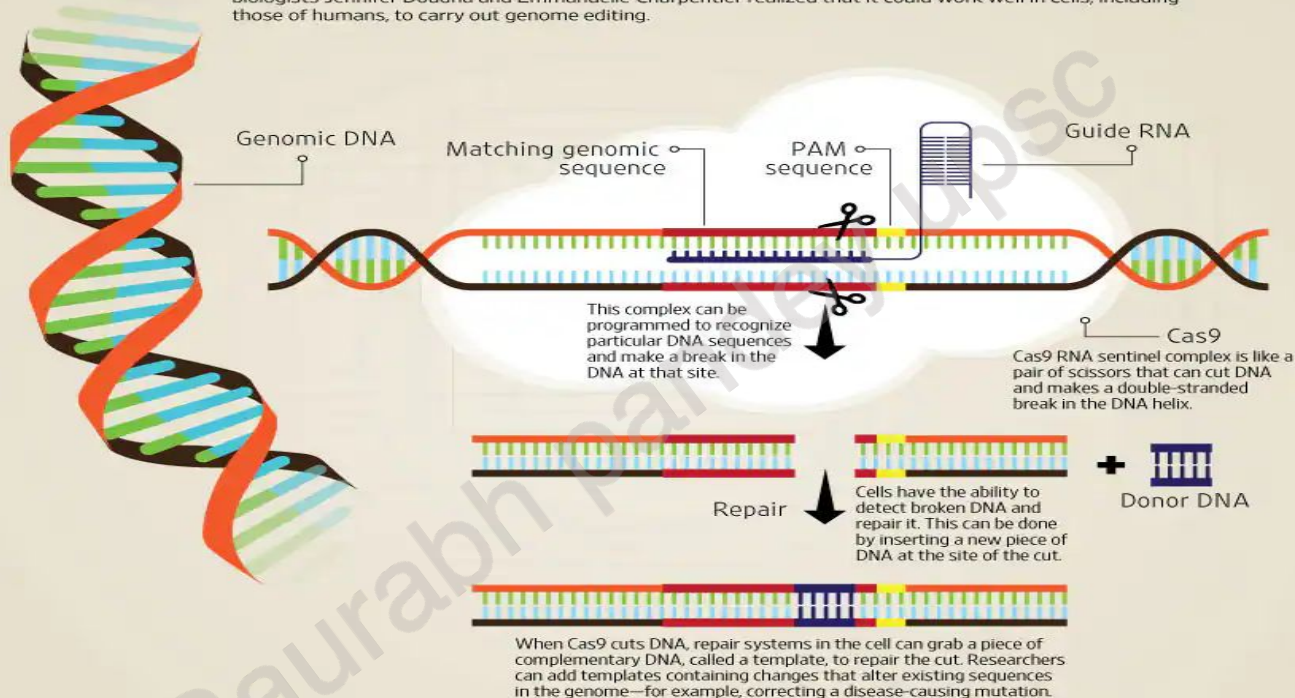
- **SNCA is abundant in neurons, especially in dopaminergic neurons.**
- **It is found near the nuclei of these cells and at the junctions between two neurons.**
- **It's capable of misfolding as well as forming filamentous structures. Misfolded proteins don't function correctly**
- **A study reported two ways in which SNCA is present: one that interferes with the integrity of cells' nuclei and another that allows the cell to degrade misfolded proteins.**
- **The former are related to diseased states while the latter is important for healthy cells  A smaller population of SNCA means fewer misfolded SNCA.**

- **Researchers achieved this by stopping the SNCA gene from expressing itself or by destroying the SNCA inside cells.**
- **Either of these interventions needs to happen only in select locations: if all the SNCA is taken away, the body will die**
- **Another workable solution has been to use a gene-silencing tool, like CRISPR-Cas9, at a precise location**

# HOW CRISPR WORKS

CRISPR-Cas9, abbreviated from clustered regularly-interspaced short palindromic repeats, is a hybrid of protein and ribonucleic acid (RNA) which works as an efficient hunt-and-cut system in bacteria. Molecular biologists Jennifer Doudna and Emmanuelle Charpentier realized that it could work well in cells, including those of humans, to carry out genome editing.

Genomic DNA

Matching genomic sequence

PAM sequence

Guide RNA

This complex can be programmed to recognize particular DNA sequences and make a break in the DNA at that site.

Cas9

Cas9 RNA sentinel complex is like a pair of scissors that can cut DNA and makes a double-stranded break in the DNA helix.

Repair

Cells have the ability to detect broken DNA and repair it. This can be done by inserting a new piece of DNA at the site of the cut.

+ Donor DNA

When Cas9 cuts DNA, repair systems in the cell can grab a piece of complementary DNA, called a template, to repair the cut. Researchers can add templates containing changes that alter existing sequences in the genome—for example, correcting a disease-causing mutation.

- When viruses infect a cell, they inject their DNA. In bacterium, the CRISPR system allows that DNA to be plucked out of the virus and inserted in little bits into the chromosome of the bacterium.

- These integrated bits of viral DNA get inserted at a site in the bacteria.

- CRISPR allows cells to record over time the viruses that they have been exposed to, so that cells are protected from those viruses.

Source: UC Berkeley, Mint research

# Nucleosynthesis: the element factory

**Karthik Vinod**

Stellar nucleosynthesis is the process by which stars forge elements inside their cores. The only element not formed in this way is hydrogen, the most abundant and lightest element in the universe: it was formed in the initial aftermath of the Big Bang.

The cores of stars have crushing pressures and temperature. For example, the sun's core temperature is about 15 million degrees C. In these harsh conditions, the nuclei of atoms undergo nuclear fusion.

The hydrogen nucleus is just one proton. Inside the core, these nuclei come together to form helium nuclei (two protons and two neutrons). This is the p-p (short for proton-proton) process.

In more massive stars, however, stellar nucleosynthesis treads a different path — one dictated by the availability of energy. More massive stars have a higher core temperature. There, in the so-called carbon-nitrogen-oxygen (CNO) cycle, the nuclei of these elements come together in different ways to form elements from helium onwards.

When a star runs out of nuclei to fuse, its core contracts. This in



The cores of stars have crushing pressures and temperature. Representative image. GETTY IMAGES/ISTOCKPHOTO

return increases its temperature, triggering nuclear fusion yet again. This process goes back and forth until the star starts to produce iron in its core. Iron is the lightest element for which fusion consumes more energy than it releases. Elements heavier than iron can only be synthesised outside a star when it goes supernova.

# Stellar nucleosynthesis

- Stellar nucleosynthesis is the process by which stars forge elements inside their cores.
- The only element not formed in this way is hydrogen, the most abundant and lightest element in the universe: it was formed in the initial aftermath of the Big Bang.
- The cores of stars have crushing pressures and temperature.
- For example, the sun's core temperature is about 15 million degrees C.
- In these harsh conditions, the nuclei of atoms undergo nuclear fusion.

- The hydrogen nucleus is just one proton. Inside the core, these nuclei come together to form helium nuclei (two protons and two neutrons).
- This is the p-p (short for proton-proton) process.
- In more massive stars, however, stellar nucleosynthesis treads a different path — one dictated by the availability of energy. More massive stars have a higher core temperature.

- There, in the so-called carbon-nitrogen-oxygen (CNO) cycle, the nuclei of these elements come together in different ways to form elements from helium onwards. When a star runs out of nuclei to fuse, its core contracts.
- This in return increases its temperature, triggering nuclear fusion yet again.
- This process goes back and forth until the star starts to produce iron in its core. Iron is the lightest element for which fusion consumes more energy than it releases.

# Renew the generalised system of preferences

In the pantheon of obscure international trade terminology, the "generalised system of preferences," or GSP, has a special place. GSP refers to an approach that has been adopted by nearly all developed countries for roughly the last half-century to offer incentives for economic reform in developing countries through lower tariffs. Each developed country has customised its own GSP programme to identify qualification criteria it deems important in economic reform, although all ensure that their programmes are constructed to avoid harm to domestic production. In short, it is the oldest and most far-reaching approach to "aid for trade" in the modern multilateral trading system, embodied in the World Trade Organization.

## Renewing GSP

What is unique about the GSP programme in the U.S. is that its authorising legislation periodically expires until Congress sees fit to renew the programme. New legislation is never an easy proposition, especially in a polarised environment, making bipartisan legislation a herculean endeavour. That is the case with GSP now. The U.S. programme expired in 2020 and despite repeated assurances of bipartisan support, it remains in limbo.

GSP can play a vital role in establishing stable market access for developing countries that otherwise struggle to tap into global trade flows. It can be especially valuable for small businesses and women-owned enterprises, thus helping to empower them beyond limited domestic markets. More recent analysis suggests that GSP is vital in offering alternatives to Chinese imports and providing an advantage to suppliers in trusted developing country markets. GSP criteria promote reforms on labour and environmental sustainability and intellectual property rights protection. GSP

**Mark Linscott**

is a Senior Advisor at the U.S.-India Strategic Partnership Forum and a former Assistant U.S. Trade Representative in the Bush, Obama, and Trump administrations

imports also help reduce the tariff bills paid by American companies, many of which are small- and medium-sized enterprises.

The coalitions of support in the U.S. are diverse. Last November, a bipartisan group of Florida members of the House penned a letter expressing their strong support for GSP renewal on an urgent basis, highlighting its importance in sourcing away from China and lowering the tariff bill for Florida's consumers and manufacturers. In an era of friendshoring and nearshoring, GSP can be an effective tool in pursuing new supply chain objectives. Surprisingly, there is even strong bipartisan support for restarting GSP talks with India.

## U.S.-India trade relationship

While there should be no need to offer additional arguments in favour of renewing GSP without further delay, the U.S.-India trade relationship may help to put support over the top. It is accepted wisdom that GSP renewal would offer an avenue for wide-ranging U.S.-India trade negotiations that can help in vaulting the bilateral trade relationship from the $200 billion it is presently at to a much higher level. It is clear there needs to be higher ambition on trade in order to take the U.S.-India strategic relationship even further.

Before the expiration of the GSP programme in 2020, negotiations between the Office of the U.S. Trade Representative and the Indian Ministry of Commerce and Industry had come close to sealing a wide-ranging deal. Estimates at the time suggested that an unprecedented bilateral trade agreement between the U.S. and India might cover as much as $10 billion in trade, including medical devices, several agricultural commodities, corn-based ethanol used for fuel, and information technology products.

The U.S. and India have already come a long distance in their trade relationship. Yet the tools they have available to achieve this increase in trade are limited. Even

though India has gone into overdrive in negotiating free trade agreements (FTAs) with a wider circle of trading partners, including the European Union, the U.K., the European Free Trade Association, Australia, and the UAE, the Biden administration is clear that the U.S. will not negotiate FTAs with any country for the moment. There are several trade dialogues between the two, but these lack the leverage for a hard-nosed trade negotiation that can shoot for ambitious results. The private sectors in both countries are teaming up to increase investments in high-profile sectors across critical and emerging technologies from smartphone manufacturing to semiconductor production, but they lack the stability in regulatory certainty and ease of doing business that a strong, enforceable trade agreement can bring.

This is where GSP should come into the picture. Each side would have much to gain through negotiations on India's GSP benefits when the U.S. Congress acts to renew the programme. Short of a change in U.S. administration policy on negotiating FTAs again, no other trade tool or policy could be more effective with India than GSP. Depending on what qualification criteria the Congress includes in the final renewal legislation, a GSP negotiation could cover trade in goods and services, protections for internationally accepted labour rights and restrictions on child labour, enforcement of environmental laws, and provisions on good regulatory practice and other areas relevant to ease of doing business.

As the U.S.-India strategic partnership continues to grow and the two countries play critical, collaborative roles in the Indo-Pacific, they should aim much higher in their trade relationship. GSP is not the full answer to comprehensively achieving this, but it would be a strong statement of their mutual desire to be on this path.

It is clear there needs to be higher ambition on trade in order to take the U.S.-India strategic relationship even further

# Generalized System of Preferences (GSP)

- **U.S. trade preference programs such as the Generalized System of Preferences (GSP) provide opportunities for many of the world's poorest countries to use trade to grow their economies and climb out of poverty.**
- **GSP is the largest and oldest U.S. trade preference program.**
- **Established by the Trade Act of 1974, GSP promotes economic development by eliminating duties on thousands of products when imported from one of 119 designated beneficiary countries and territories.**

- **GSP boosts economic growth and development in many developing countries.**

- **In the GSP arrangement, certain imports from beneficiary countries are allowed concessions such as zero tariffs.**

- **GSP involves reduced/zero tariffs of eligible products exported by beneficiary countries to the markets of GSP providing countries.**

# Clean-up ritual



**Turtle tradition:** Men carry a turtle to be released into the sea during the *Segara Kerthi,* a ritual which seeks to physically and spiritually clean the sea, held as part of the opening of the 10th World Water Forum in Serangan Island in Bali in Indonesia on Sunday. REUTERS

# Segara Kerthi,

- **Segara Kerthi, a ritual which seeks to physically and spiritually clean the sea, held as part of the opening of the 10th World Water Forum in Serangan Island in Bali in Indonesia.**
- **The Segara Kerthi ritual is carried out to seek blessings from the Almighty for a physically and spiritually clean sea as a source of water.**

# HPV vaccine prevents cervical cancer in deprived groups: study

**The Hindu Bureau**

The human papillomavirus, or HPV, vaccine is cutting cases of cervical cancer right across the socio-economic spectrum, with most cases being prevented in more deprived groups, according to a major study funded by Cancer Research UK.

Until now, there had been concerns that the HPV vaccine could have an unequal impact across society. After carrying out the longest follow-up on the effectiveness of the HPV vaccine, researchers at Queen Mary University of London concluded the HPV vaccination programme in England is helping to close some inequalities in cervical cancer. The results were published in the journal *BMJ*.

## Public interventions

Due to a typically higher incidence of cervical cancer in more deprived groups, researchers found that more cases were prevented in the most deprived group (around 190), compared to the least deprived group (around 60) in a study that included approximately 6,50,000 people offered vaccination aged 12-18 years in each of the five deprivation groups.

The study reflected the huge success of the school-based vaccination programme, showing that well-executed public health interventions can help to reduce health inequalities.

The study adds even more weight to the evidence that HPV vaccination works. Researchers found that over a 12-year period, the vaccine reduced cervical cancer incidence rates by nearly 90% and pre-cancerous conditions by around 95% in women who were offered routine vaccination at 12-13 years old in England. The study shows that the vaccine is much more effective when taken up by children aged eight years (12-13 years) than later in life.

Although the life-saving HPV vaccine currently reaches people from all backgrounds, Cancer Research U.K. warns that some inequalities remain in cervical cancer incidence, and more work is needed to improve the health of the most deprived groups. Overall, cervical cancer rates are higher in people from deprived backgrounds across the U.K. Researchers said this is partly due to people being at greater risk from HPV and barriers that can drive lower screening attendance.

Cancer Research U.K. scientists helped to prove the link between HPV and cervical cancer 25 years ago. Cervical cancer rates in the U.K. have fallen by almost a third since the early 1990s. The HPV vaccination programme was first introduced to England in 2008.

# Human papillomavirus (HPV)

- **Human papillomavirus (HPV) is a small, non-enveloped deoxyribonucleic acid (DNA) virus that infects skin or mucosal cells.**
- **The circular, double-stranded viral genome is approximately 8-kb in length.**
- **Two prophylactic HPV vaccines have been available since 2006.**
- **Both vaccines are prepared from virus-like particles (VLPs) produced by recombinant technology.**
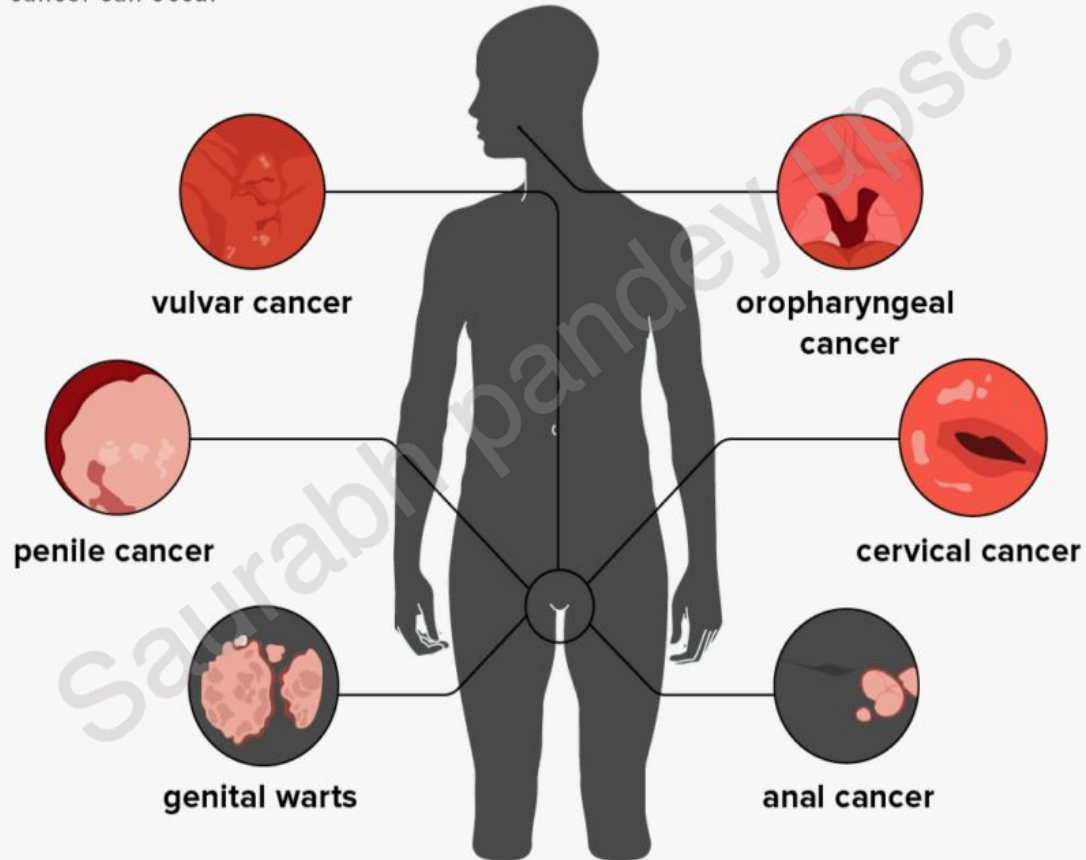
# Tool use promotes foraging success in sea otters

Using tools, like shells and rocks, to open their often thick-shelled mollusk prey increases foraging success in sea otters and protects their teeth from damage by allowing the animals to eat prey that would otherwise be difficult to obtain. The findings suggest that this behaviour is a necessity for the survival of some otters in environments where preferred prey is in short supply. The tool-use frequency enabled the use of a variety of prey, which led to higher energy consumption rates and reduced tooth wear.

# The sea otter

The sea otter can live its entire life without leaving the water.

Its fur is the densest of any animal on Earth—an estimated 1 million hairs per square inch. That's because, unlike its fellow marine mammals, it has no blubber to keep it warm.

. The sea otter is one of the few mammal species on Earth to use a tool to help it hunt and feed.

It wedges a rock between its chest and the "armpit" of a foreleg and pounds shells against it to open them up.

..

- **The sea otter also hammers rocks against strongly gripping abalone shells to pry them off of rocks and feed on their tasty insides.**
- **The sea otter is the only marine mammal capable of flipping over boulders on the sea floor—in this case to search out food.**
- **And the only marine mammal to catch fish with its forepaws and not its mouth**

- If a sea otter's fur becomes dirty, it has trouble absorbing the air needed to keep it warm.
- Therefore, sea otters are obsessive about keeping their fur clean, and groom themselves practically non-stop when they're not eating or sleeping.
- International Union for the Conservation of Nature (IUCN) as "endangered."
- polar bears in the Arctic, sea otters are considered keystone species in their ecosystems, because they affect great influence on their environments.

- For instance, they plentifully eat sea urchins, which eat kelp in great abundance.
- When the sea urchins' populations are controlled by sea otters, vital kelp forests can flourish
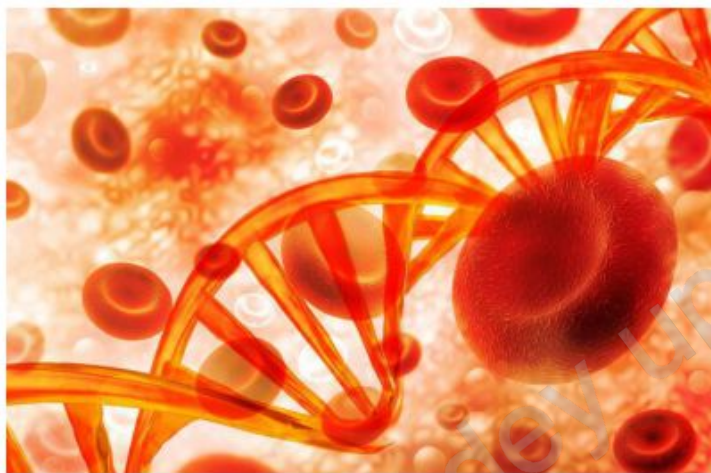
# Miniaturised probe help track blood clots in tiny arteries

Researchers have engineered a tiny, snake-like imaging probe – a miniaturised endovascular neuro optical coherence tomography – that can navigate the labyrinth of tiny arteries in the brain, offering a tool to guide medical interventions for strokes and other artery conditions. In a human trial, the probe captured disease-linked features in blood vessels, supporting its diagnostic and clinical utility. The probe successfully captured 3D images of the patients' arteries and various artery segments.

# Tomography

**Tomography is an x-ray technique in which shadows of superimposed structures are blurred out by a moving x-ray tube.**

**ADVANCE BOOKS FOR UPSC**

**BOOKS SERIES**
**(FOR UPSC 2025/26 )**

Advance books coverage

- M. Laxmikant -polity
- Spectrum - history
- GC Leong - geography
- Shankar ias environment
- Governance in india By M .laxmikant
- Lexicon book on ethics
- TMH Book on internal security
- Indian society by SC dubey

starting 1st june 2024

BY SAURABH PANDEY SIR



ATTENTION!! BATCH FOR 2025/26 LAUNCHED
connect with sir -9057921649

**CURRENT AFFAIRS PLUS**
**(FOR UPSC 2025 )**

**INCLUDES**

- PIB Analysis with pdf
- Down to earth
- physics.org
- science daily
- Major newspapers
- With practice test and Mains Mock

starting 1st may 2024

BY SAURABH PANDEY SIR

# FOR UPSC 2025 /26

**Launched**

**1- Current affairs plus - PIB, YOJANA, Down to earth , physics.org , Major newspapers.**

**2- Books series - all advanced books in one course**

## UPCOMING

1- Mains Mentorship program
2- GS-1 ,2,3 and 4
3- Mapping
4- NCERTS
5- Test series for 2025
6- essay
7- Agriculture optional

**DOWNLOAD - Saurabh pandey cse app**

**+91 90579 21649**

# Target Mains -2024/25

Q ''Endemism of wild species depends on various  factors '' Explain

प्रश्न "जंगली प्रजातियों की स्थानिकता विभिन्न कारकों पर निर्भर करती है" स्पष्ट करें

# Connect with sir 9057921649

send your answer - Saurabh pandey upsc telegram channel