Topics

- AI in drug development
- Can parties be derecognised or de registered ??
- Trade Protectionism
- Mapping - New caledonia, Nagorno karabakh
- **Mains**

By saurabh Pandey

THE HINDU

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Target Mains -2024/25

Q Explain the role of AI in health sector

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The use of AI in drug development

What are target proteins and how are they identified? How do AI-based tools AlphaFold 3 and RoseTTAFold All-Atom help in predicting the correct target protein and its interactions with drugs? Where does India stand in the field of computational drug development?

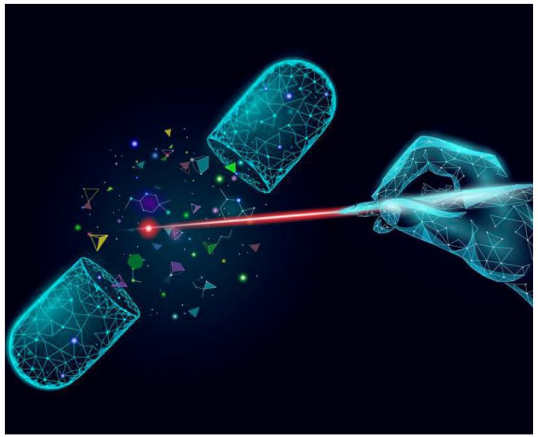
EXPLAINER

Binay Panda

Drug development is an expensive and time-consuming process. However, the advent of Artificial Intelligence (AI) has opened up a world of possibilities with respect to fast-tracking drug development.

How does the process start?
The process of developing a drug starts with identifying and validating a target. A target is a biological molecule (usually a gene or a protein) to which a drug directly binds in order to work. The overwhelming majority of targets are proteins. Only those proteins with ideal sites where drugs can go and dock to do their business are druggable proteins.

Target proteins are identified in the discovery phase, wherein a target protein sequence is fed into a computer which looks for the best-fitting drug out of millions in the library of small molecules for which the structures are stored in the computer. The process assumes that the structures of the target protein and drug are known. If not, the computer uses models to understand the sites where a drug can bind. This discovery process avoids time-consuming laboratory experiments that require expensive chemicals and reagents and have a high failure rate. Once the suitable protein target and its drug are identified, the research moves to the pre-clinical phase, where the potential drug candidates are tested outside a biological system, using cells and animals for the drug's safety and toxicity. After this, as part of the clinical phase, the drug is tested on a small number of human patients before being used on more patients for efficacy and safety. Finally, the drug undergoes regulatory approval and marketing and post-market survey phases. Due to a high failure rate, the discovery phase limits the number of drugs that pass and carry on to the pre-clinical and clinical phases.



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How can AI help this process?
AI has the potential to revolutionise target discovery and understand drug-target interaction by drastically cutting down time, increasing the accuracy of prediction of interaction between a drug and its target, and saving money. The development of two AI-based prediction tools, AlphaFold and RoseTTAFold, developed by researchers at DeepMind, a Google company, and the University of Washington, U.S., respectively, has provided a major scientific breakthrough in the last four years in the area of computational drug development. Both tools are based on deep neural networks. The tools' neural networks use massive amounts of input data to produce the desired output – the three-dimensional structures of proteins published recently, the new avatars of AlphaFold and RoseTTAFold, called AlphaFold 3 (developed jointly by Isomorphic Labs, a DeepMind spinoff) and RoseTTAFold All-Atom, respectively, take the capability of these tools to an entirely new level. The significant difference between the upgraded versions and their previous forms is their capability to predict not just static structures of proteins and protein-protein interactions but also their ability to predict structures and interactions for any combination of protein, DNA, and RNA, including modifications, small molecules and ions. Additionally, the new versions use generative diffusion-based architectures (one kind of AI model) to predict structural complexes. In a test with 400 interactions between targets and their small molecule drugs, AlphaFold 3 accurately predicted their interactions 76% of the time versus 40% by RoseTTAFold All-Atom.

What are the drawbacks?
With all the promise and potential in drug development, AI tools have limitations. For example, the tools can, at best, provide up to 80% accuracy in predicting interactions (the accuracy comes down drastically for protein-RNA interaction predictions). Second, the tools can only aid a single phase of drug development, target discovery and drug-target interaction. It will still have to go through the pre-clinical and clinical development phases, and there is no guarantee that the AI-derived molecules will result in success in those phases. Third, one of the challenges with diffusion-based architecture is model hallucinations, where insufficient training data causes the tool to produce incorrect or non-existent predictions. Finally, unlike the previous versions of AlphaFold, DeepMind has not released the code for AlphaFold 3, restricting its independent verification, broad utilisation and use for protein-small molecule interaction studies.

What about India?
Developing new AI tools for drug development requires large-scale computing infrastructure, especially ones with fast Graphics Processing Units (GPUs) to run multiple tasks with longer sequences. GPU chips are expensive, and with newer and faster ones being produced by hardware makers every year, they have a quick expiration date. India needs such large-scale computing infrastructure. That, along with a lack of skilled AI scientists, unlike in the U.S. and China, is the second reason why researchers in India could not establish a first-mover advantage in developing AI tools for drug development despite the country having a rich history in protein X-ray crystallography, modelling and other fields of structural biology. However, with a growing number of pharmaceutical organisations, India can lead the way in applying AI tools in target discovery, identification, and drug testing.

Binay Panda is Professor at JNU, New Delhi and posts at @ganitlabs.

THE GIST

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PRESCOUTER

AI in drug discovery & development

Aggregating and synthesizing information

ARPEGGIO BIOSCIENCES

- Combines new RNA sequencing technologies with proprietary machine learning
- Mine data to help quickly identify the direct targets of a novel drug

TRL 5

Understanding disease mechanisms

PHENOMIC.AI

- Analysis of genome-wide screens
- Identify proteins involved in regulating the cell cycle
- Discovery of the next generation of therapies against cancer.

TRL 3

STRUCTURA BIOTECHNOLOGY

- Training computer vision and machine learning models on cryo-EM data
- Provide detailed spatial 3D structure of proteins and molecular complexes
- CryoSPARC System™ software enables reconstructions of research and drug targets.

TRL 8

Generating novel drug candidates

Atomwise

- Structure-based deep CNN
- Predict bioactivity of small molecules
- Predict new active molecules for targets with no previously known modulators
- Development of agricultural pesticides (partnered with Monsanto)

TRL 5

twoXAR

- Screen compound libraries for efficacy against a disease
- Identify biologic targets
- Uncover novel disease biology hypotheses supported by real world data.

TRL 4

ReviveMed

- Network-based machine learning approach
- Measure metabolite masses fast and inexpensively
- Predict the identity of each metabolite mass
- Integrate data with other large-scale molecular datasets

TRL 3

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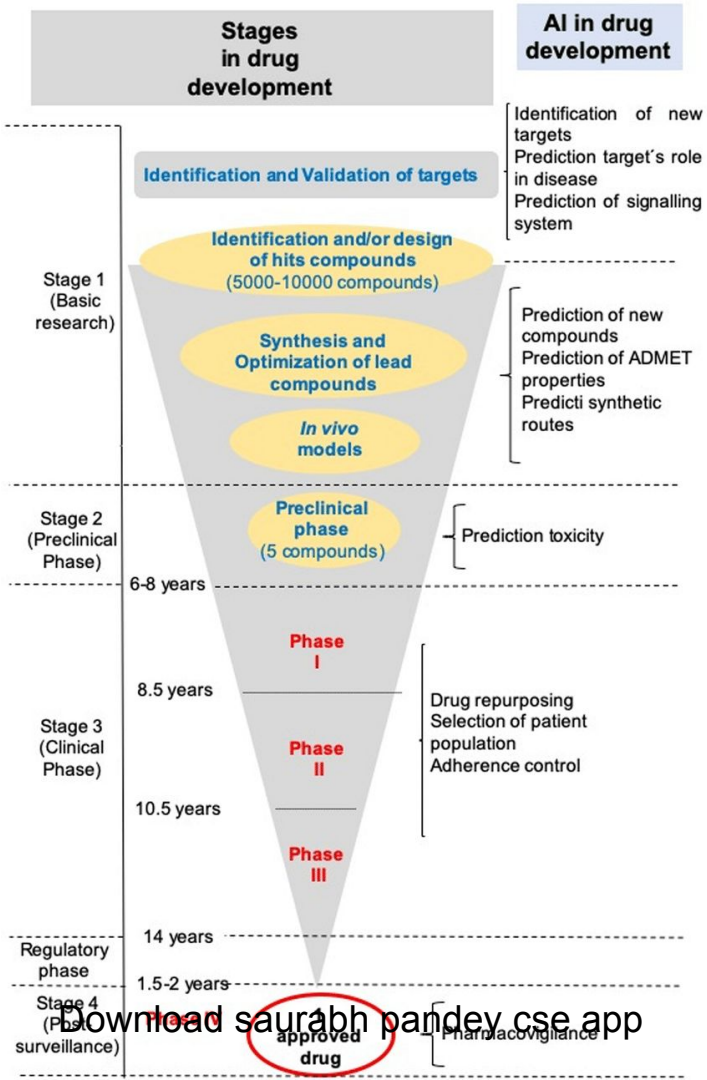

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Ways in Which AI Transforms Drug Discovery

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About GPU

- What does GPU stand for?
- Graphics processing unit, a specialized processor originally designed to accelerate graphics rendering.
- GPUs can process many pieces of data simultaneously, making them useful for machine learning, video editing, and gaming applications.
- GPUs may be integrated into the computer’s CPU or offered as a discrete hardware unit.

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Can parties be de-recognised or de-registered?

Does the Election Commission have the power to de-recognise a political party for violation of the MCC?

Rangarajan. R

The story so far:

The Election Commission of India (ECI) in its report on enforcement of Model Code of Conduct (MCC) has stated that it expects star campaigners to lead by example and not vitiate the fabric of society. This has raised a debate about ECI powers to rein in MCC violations.

What are registered parties?

Section 29A of the Representation of the People Act, 1951 (RP Act) lays down the requirements for registration of a political party with the ECI. Any political party that seeks registration should submit a copy of its memorandum/constitution. Such document should declare that the party shall bear true faith and allegiance to the Constitution of India. It should also bear allegiance to the principles of socialism, secularism and democracy, and uphold the sovereignty, unity and integrity of India. Registered political parties enjoy the following legal benefits - (a) tax exemption for donations received under Section 13A of the Income Tax Act, 1961, (b) common symbol for contesting general elections to the Lok Sabha/State Assemblies, and (c) twenty 'star campaigners' during election campaign. As per the ECI, there are 2,790 active registered political parties in India.

What are recognised parties?

A registered party is referred to as a Registered Unrecognised Political Party (RUPP). Political parties are recognised as a 'national' or 'State' party under the provisions of The Election Symbols (Reservation and Allotment) Order, 1968 (Symbols Order) by the ECI. The criteria for recognition at the 'national' or 'State' level consists of winning requisite number of seats and/or obtaining required percentage of votes in a general election to Lok Sabha or State Assembly. At present, there are six 'national' parties, and sixty-one 'State' parties that have been recognised. These recognised parties enjoy additional concessions of having a reserved symbol during elections and forty 'star campaigners'.

What are the issues?

It has been noticed that less than a third of RUPPs contest elections. The RP Act does not confer explicit powers on the ECI to de-register any political party if it fails to contest elections, conduct inner-party elections or lodge requisite returns. The Supreme Court in *Indian National Congress versus Institute of Social Welfare & Ors* (2002) had held that the ECI does not have power to de-register any political party under the RP Act. It may de-register only under exceptional circumstances like registration being obtained by fraud or the political party ceasing to have allegiance to the Constitution or if it is declared unlawful by the Government. The RUPPs that don't contest elections raise concerns over the possible misuse of income tax exemption and donations collected being used for money laundering.

The MCC prohibits using caste and communal feelings to secure votes, and bribing or intimidation of voters. Recognised political parties are guilty of violating the MCC on various occasions. However, it has been observed that the ECI on such occasions at best bars leaders from campaigning for a short period of two to three days.

What needs to be done?

The ECI in its memorandum for electoral reforms (2016) has suggested amendment to the law that would empower the ECI to deregister a party. The Law Commission in its 255th report (2015) on 'Electoral reforms' has also recommended amendments for de-registration of a political party if it fails to contest elections for 10 consecutive years. These recommendations should be implemented. Under Paragraph 16A of the Symbols order, the ECI has the power to suspend or withdraw recognition of a recognised political party for its failure to observe MCC or follow lawful directions of the Commission. It has probably been used only once for three weeks in 2015 when the recognition of National People's Party was suspended for failure to follow the directions of the ECI. Strict action under this provision would have a salutary effect in ensuring adherence to the MCC.

Rangarajan R is a former IAS officer and author of 'Polity Simplified'. He trains civil-service aspirants at 'Officers IAS Academy'. Views expressed are personal.

THE GIST

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EC - Registered vs Recognised party

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Overcapacity claims by U.S., Europe are 'trade protectionism', says China

Reuters
BEIJING

China said on Thursday that U.S. and European assertions of excess capacity were "naked trade protectionism" and that efforts to constrain new energy exports from the World's No.2 economy would frustrate global efforts to tackle climate change.

Growing alarm over Chinese industrial overcapacity flooding the European Union with cheap products is opening a new front in the West's trade war with Beijing, which kicked off with Washington's import tariffs in 2018.

"A country cannot be labelled as having excess capacity just because it has more capacity than it needs," He Yadong, a Commerce Ministry spokesperson said.

Tricks of the trade: Supply and demand need to match and be adjusted according to a global perspective, a spokesperson said. AFP

"Production and consumption are global, and supply and demand need to match and be adjusted according to a global perspective."

Steep tariff

On Tuesday, the Biden administration unveiled steep tariff increases on $18 billion of exports, including a quadrupling of tariffs on Chinese new energy vehicles.

"Demand for new energy products will continue to expand in this global green transformation," Mr. Yadong said, comparing China's dominance in green technologies to Boeing and Airbus' duopoly in the global aviation market.

He asserted that global new energy vehicle sales needed to increase if the international community is to achieve carbon neutrality by 2030.

"The countries concerned are worried about their competitiveness and market share," Mr. Yadong added.

"Overcapacity is not a product, it is an anxiety."

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Trade Protectionism

1. Trade protectionism refers to government policies and actions taken to restrict or limit international trade in order to protect domestic industries from foreign competition.
2. It involves the implementation of various measures to shield domestic producers from foreign competitors and safeguard local employment and industries.
3. The primary objective of trade protectionism is to promote and support domestic industries, improve the trade balance, and preserve national economic interests.
4. Trade protectionist measures can take different forms, including:
5.

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Tariffs: Imposing taxes or duties on imported goods, making them more expensive and less competitive compared to domestic products.

Import quotas: Limiting the quantity or value of specific goods that can be imported into a country during a specified period.

Subsidies: Providing financial assistance or incentives to domestic industries to make their products more competitive and reduce their production costs.

Regulatory barriers: Implementing strict regulations, standards, or certifications that foreign products must meet, creating additional hurdles for imports.

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Embargoes and sanctions: Completely banning or restricting trade with specific countries for political or economic reasons.

Currency manipulation: Artificially devaluing a country's currency to make exports more competitive and imports more expensive.

Domestic content requirements: Mandating a certain percentage of domestic components or labor in products sold within the country.

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YEREVAN

Armenia, Azerbaijan agree deal on disputed sections of shared border

AFP

Armenia and Azerbaijan said on Thursday they had agreed a deal on disputed sections of their shared border, a new step towards normalising ties between the historic rivals. The deal between the two Caucasus nations includes the return to Azerbaijan of four border villages seized by Armenia in the 1990s. AFP

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Violence rages in New Caledonia as France rushes security forces to islands

Associated Press
PARIS

Violence raged across New Caledonia for the third consecutive day on Thursday, hours after France imposed a state of emergency in the French Pacific territory, boosting security forces' powers to quell deadly unrest in the archipelago where some residents have long sought to break free from France.

French authorities in New Caledonia and the Interior Ministry in Paris reported that five people, including two police officers, have been killed in the violence after protests earlier this week over voting reforms pushed by President Emmanuel Macron's government turned deadly.

At least 60 members of the security forces were injured and 214 people were arrested in the Thursday's clashes with police, arson and looting, according to the territory's top French official, High Commissioner Louis Le Franc.

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Two members of the island's Indigenous Kanak community were among the five dead, French Interior and Overseas Territories Minister Gerald Darmanin said on Thursday.

Mr. Darmanin said 10 people, all alleged members of the pro-independence movement known as The Field Acton Coordination Unit, have been placed under house arrest. In April, the group had backed several protests against French authorities on the island.

The National Council of Chiefs of the Indigenous Kanak people condemned "all acts of vandalism and gun violence" as "unjustifiable," but rejected the allegations that members of The Field Action Coordination Unit have been involved in the deadly violence.

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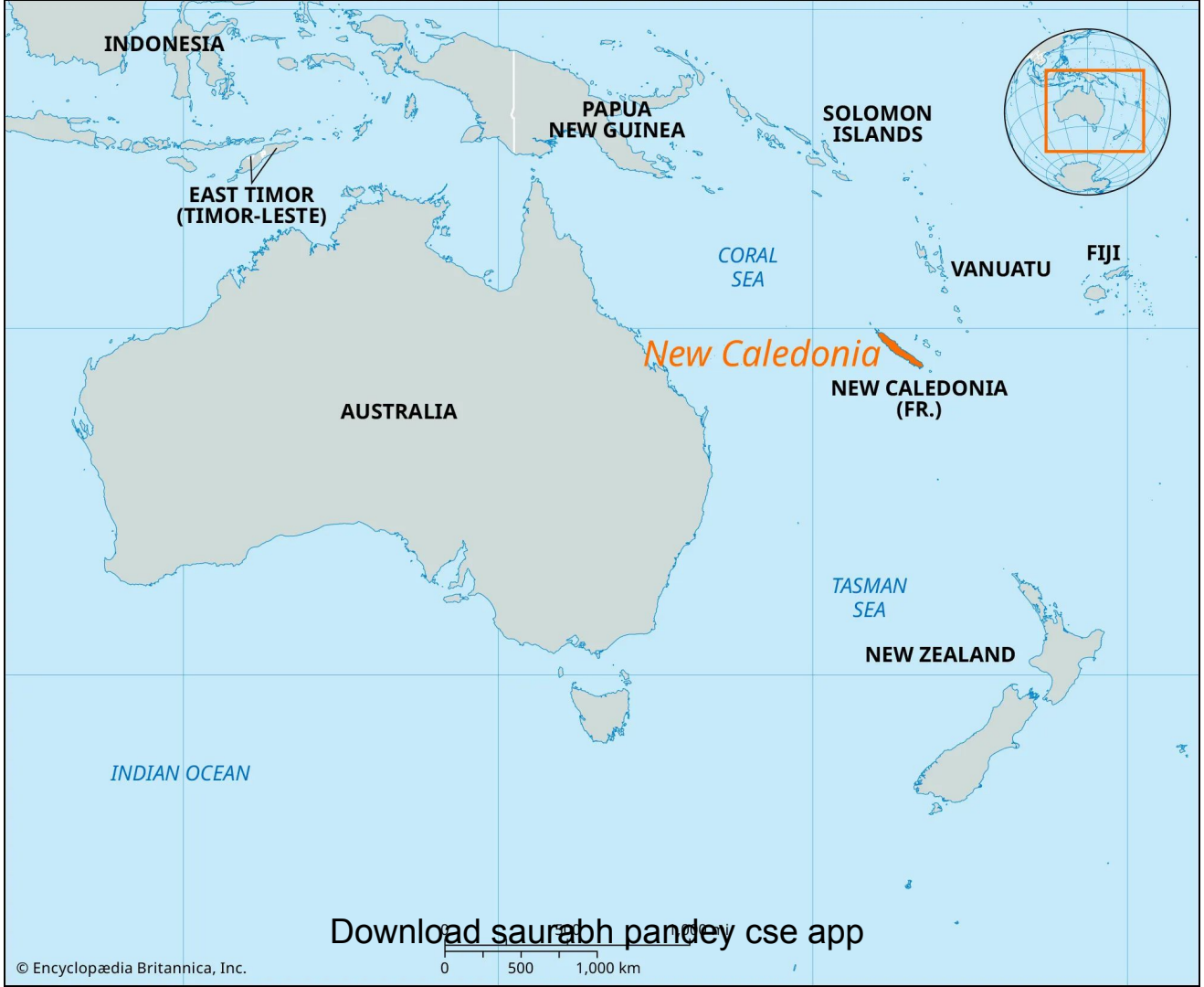

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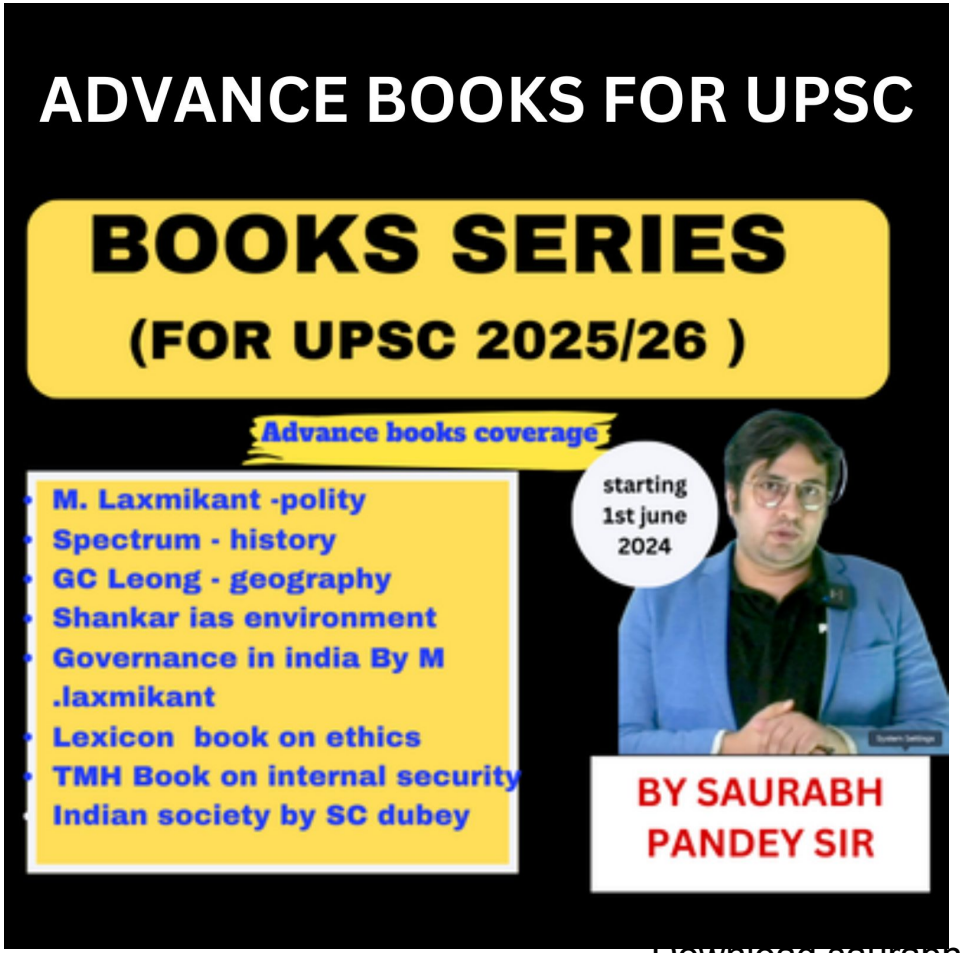

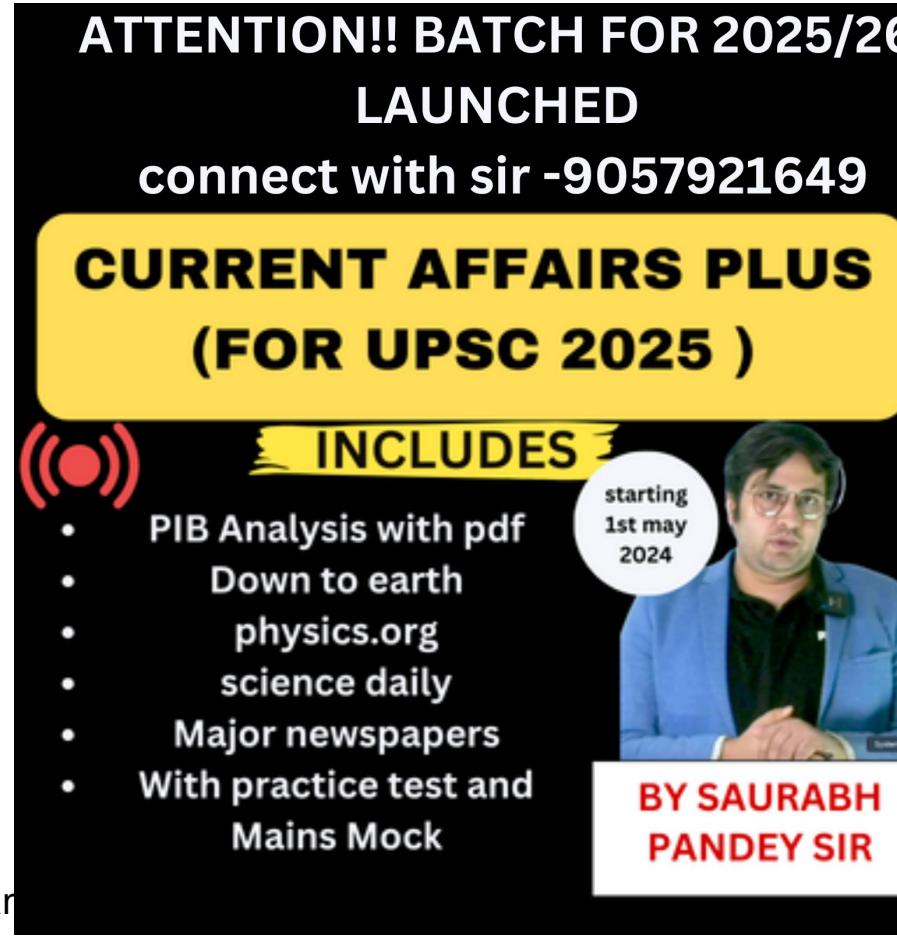

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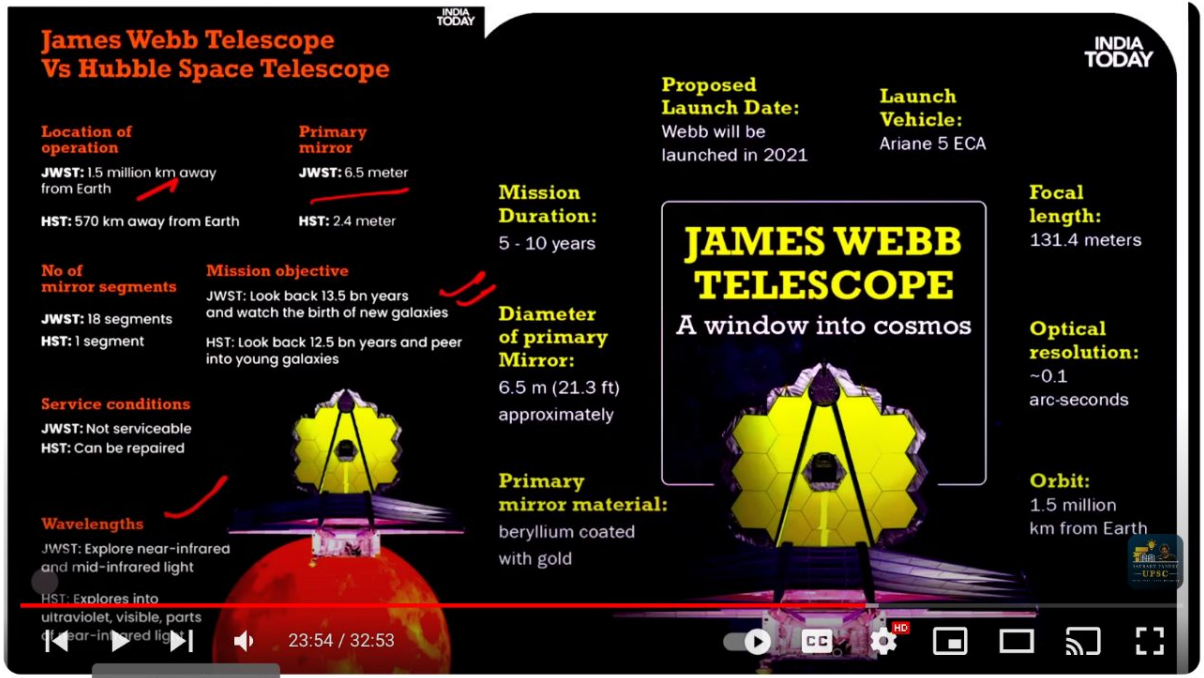

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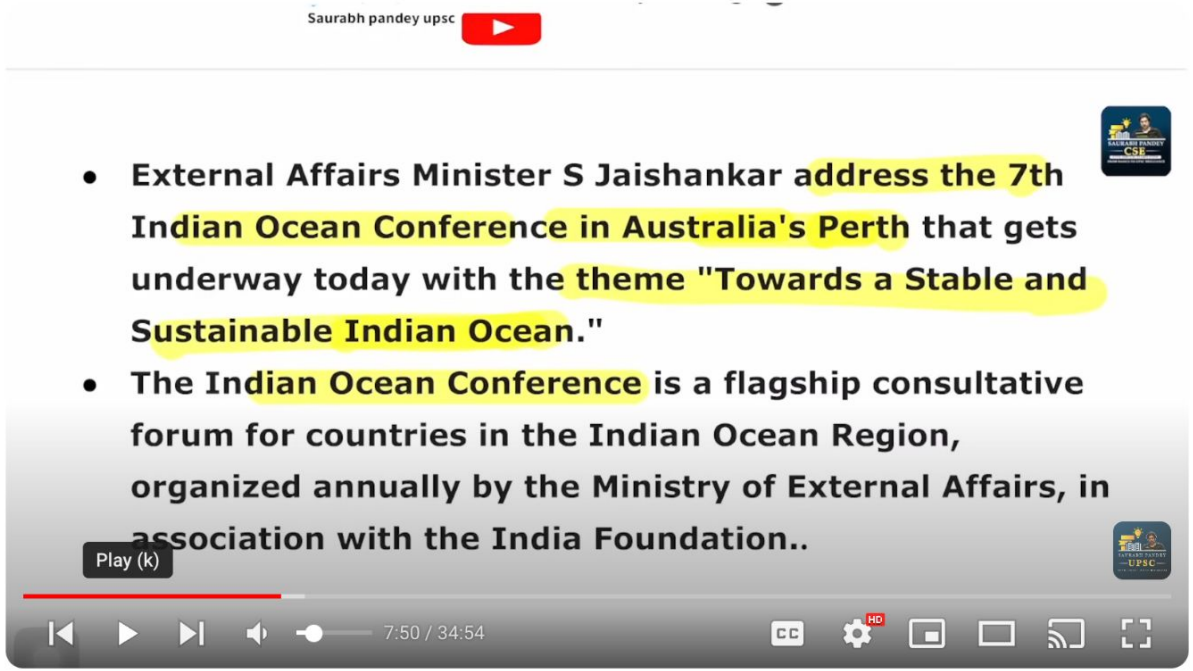

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61. Which of the following were objectives of the G20 Summit, 2023 under India's Presidency?

1. Green development
2. Accelerating progress on SDGs
3. Women-led development

Select the correct answer using the code given below.

(a) 1 and 2 only

(b) 2 and 3 only

(c) 1, 2 and 3

(d) 1 and 3 only

64.

65.

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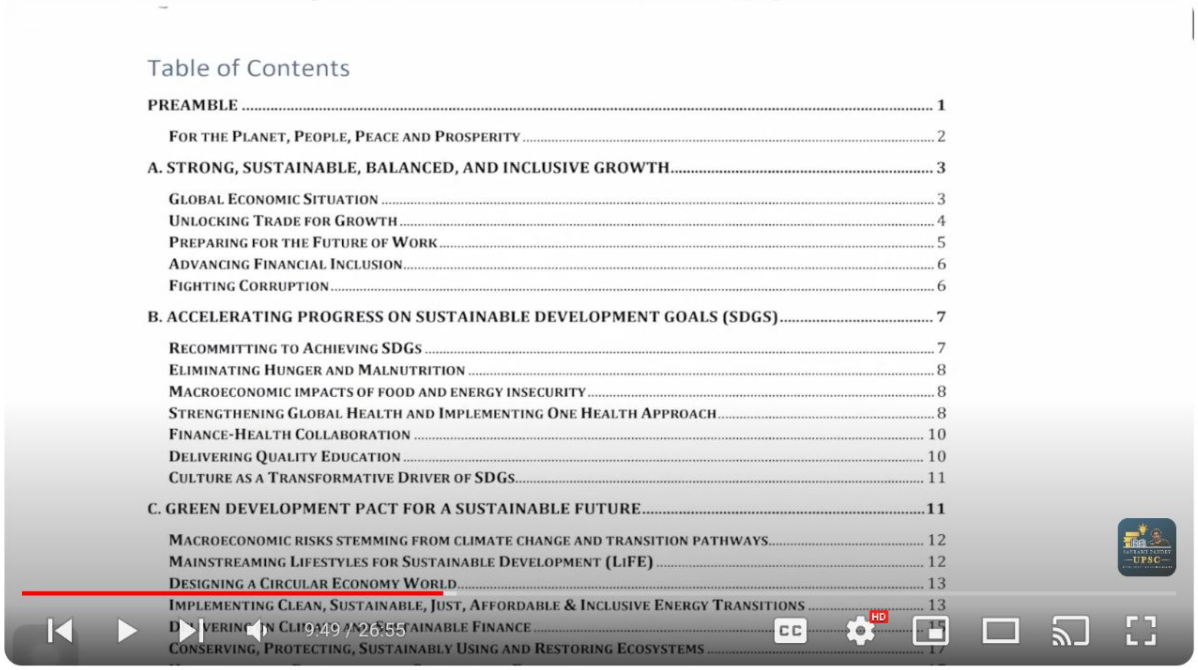

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Q Explain the role of AI in health sector

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