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MINISTRY OF SCIENCE AND TECHNOLOGY



MK Yadav Sir

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THE HINDU Pg 9/Sep 1

2G-ETHANOL

(Syllabus: GS Paper 3 – Env and Eco)

Centre plans to boost '2G ethanol' production, set up enzyme-manufacturing facilities to reduce imports

Jacob Koshy
NEW DELHI

Days after the Centre unveiled its BioE3 policy to boost bio-technology-centric manufacturing in India, the Department of Biotechnology is contemplating setting up enzyme-manufacturing facilities to bolster ethanol production, according to scientists and officials with the department.

The first such plant may come up in Manesar, Haryana and will likely be a supplier to proposed 2G bio-ethanol plants in Mathura (Uttar Pradesh), Bhatinda (Punjab) and an existing plant in Panipat. Among other things, the BioE3 (Biotechnology for Economy, Environment and Employment) policy cleared by the Union Cabinet last week aims to set up 'bio-foundries' that will produce biotechnology-developed feedstock and ethanol annually by 2025-26. Of this, about 10.16 billion litres will go towards meeting the fuel-blending mandate of E20. '2G' or second generation bioethanol is ethanol that is produced from rice-straw as opposed to the conventional method of sourcing it from molasses (sugar cane).

In 2022, the Indian Oil Corporation set up a first-of-its-kind 2G ethanol plant in Panipat that uses rice stubble – the burning of which spikes pollution in North India – as feedstock. The plant, theoretically capable of producing one lakh litres of ethanol a day runs at 30% capacity and needs 1.5 lakh to 2 lakh tonnes of rice straw per year, which is generated at the end of the sowing period in September-October.



The use of agriculture residue as fuel sources could curb the practice of burning stubble that often leads to pollution. AFP

Critical ingredients

However a critical ingredient these enzymes are imported and constitute a significant component of the cost of the 2G-ethanol production process, said Ramesh Sonthi, Director, International Centre for Genetic Engineering and Biotechnology (ICGEB). "We have developed enzymes that are as good, if not better, than the ones currently used for the production of ethanol at Panipat. We have been able to show its efficacy in producing up to be able to produce at least 20,000 litres of ethanol at Panipat using the ICGEB-Praj processes.

The enyzmes in question are derived from tweaking a fungus that belongs to a broader family of fungi called *Penicillium funoculosum*. However, it is only through several steps of genetic engineering that the fungus can be tweaked to produce the necessary enzymes in sufficient quantity that can then act as an efficient hydrolyser of organic refuse such as rice stubble.

"It is a cell-free system with enzymes available now to digest the biomass. So eventually what you have after digestion is a free sugar, which can be fermented not only for ethanol but to make cosmetics, active pharmaceutical ingredients," Mr. Yazdani said.

He estimates that if India's future ethanol needs rely on locally developed enzymes it could mean a roughly two-thirds reduction cost in procuring the enzymes.

A report by the NITI Aayog on India's ethanol blending programme estimates that a litre of ethanol requires 2.3 kg of rice, 2.6 kg of maize or 50 kg of sugar cane. Because these are key food crops, relying on them for fuel means using land for food for fuel. Secondly these crops are extremely water-guzzling. The recommendation thus is to rely on agriculture biomass, and further municipal solid waste, to serve as the feedstock for ethanol. Additionally, use agriculture residue as fuel sources, also translates to an alternative use of stubble that is otherwise burned by farmers to clear the land for cropping. This year Punjab alone is estimated to produce 20 million tonnes of rice stubble.

Praj Industries, an industrial biotechnology company, is the technology licensor (of enzymes from Danish Biotechnology company, Novozymes).

"We are now currently working with Praj and they have tested our enzyme and said it as good as the ones they use. They are going to work with us on techno-economic analysis as well as the building of plants," Dr. Shams Yazdani, senior scientist at the

Context: To boost ethanol production, the Centre proposes dedicated enzyme manufacturing, with the first plant likely to be established in Manesar, Haryana, supplying 2G bio-ethanol plants in Uttar Pradesh, Punjab, and Haryana.

2G-Ethanol

- **About**: It is produced from rice-straw as opposed to the conventional method of sourcing it from molasses (sugarcane).
- **Also known as**: Cellulosic ethanol, "second-generation," or "advanced biofuel," is ethanol produced from a plant fiber called cellulose.
    - Cellulose forms the cell wall of plant cells and is a polymer made up of glucose molecules linked in a long chain, often with various chemical modifications.
- **Digestibility of Cellulose:** Humans and most domestic animals cannot digest cellulose, although dietary fiber, which includes cellulose, is essential for proper gut functioning.
- **Utilization of Agricultural Waste:** Using cellulose for ethanol production allows the inedible parts of agricultural plants, such as corn and sugarcane, to be utilized, preventing waste and increasing agricultural efficiency.
- **Environmental Impact of 2G Ethanol:** Cellulosic ethanol can reduce the carbon footprint of crops by up to 85% compared to first-generation (1G) ethanol, which is produced from sugar and starch.
- **GHG Emission Reduction**: Depending on the feedstock used, cellulosic ethanol can reduce greenhouse gas (GHG) emissions by 88% to 108% compared to gasoline, making it a sustainable alternative fuel that contributes to reducing air pollution.

Enzyme Derivation from Fungus

- **About:** The enzymes in question are derived from modifying a fungus that belongs to the broader family Penicillium funoculosum.
- **Enzyme Production**: Genetic engineering is required to modify the fungus to produce sufficient quantities of the enzymes, which can then efficiently hydrolyze organic waste like rice stubble.
- **Fungi Growth**: The fungus, found in soil and solid waste (e.g., rice stubble), can be cultivated to secrete the necessary enzymes.
- **BioE3 Programme and Its Vision**: The BioE3 programme, part of a larger initiative, aims to move away from fossil fuels towards biological and biotechnological solutions, positioning India at the forefront of this global shift.

INDIAN EXPRESS

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RULE 170 OF DRUGS ACT

(Syllabus GS Paper 2 – Gov. Policies)

RULE 170 OF DRUGS ACT, OVER WHICH AYUSH MINISTRY WAS PULLED UP

ANONNA DUTT
NEW DELHI, SEPTEMBER 1

JUSTICES HIMA KOHLI and Sandeep Mehta, while hearing the ongoing Supreme Court case against Patanjali Ayurved, pulled up the AYUSH ministry for its July 1 notification asking state licensing authorities "not to initiate/take any action under" Rule 170 of the Drugs and Cosmetics Act.

The rule, introduced in 2018, is designed to prevent misleading advertisements of AYUSH products. The AYUSH ministry's July 1 notification reiterated its position made in a previous letter, dated August 29, 2023.

What is Rule 170?

In 2018, the government brought in Rule 170 to govern the manufacture, storage, and sale of medicines in the country, "specifically for controlling inappropriate advertisements of Ayurvedic, Siddha and Unani medicines".

The rule prohibits AYUSH drug manufacturers from advertising their products without approval and allotment of a unique identification number from the state licensing authority. The manufacturers have to submit details such as textual references and rationale for the medicine from authoritative books, indication for use, evidence of safety, effectiveness, and quality of drugs.

The rule states that the application will be rejected if the manufacturer does not provide their contact details, if the contents of the advertisement are obscene or vulgar, products for enhancement of male or female sexual organs, depicts photographs or testimonials from celebrities or government officials, refers to any government organisation, gives false impression or makes misleading or exaggerated claims.

The rule was introduced after a parliamentary standing committee highlighted the problem of misleading claims, and the need for the AYUSH ministry to proactively pursue the issue.

What are challenges to regulate AYUSH drugs?

Like allopathic medicines, manufacturers of AYUSH drugs also have to seek a license from the drug controller. As per the Drugs and Cosmetics Act, phase I, II, and III trials for approval of new allopathic medicines or equivalence studies for generic versions have to be conducted before a drug is cleared for marketing.

However, such trials are not necessary for AYUSH drugs. According to the aforementioned act, most AYUSH drugs can be approved simply based on the rationale provided in authoritative texts of that particular stream. Safety trials have to be conducted only for formulations that use around 60 specific ingredients listed in the act, such as snake venom, snake head, heavy metals such as arsenic and mercury, and compounds such as copper sulphate.

For licensing of drugs containing these ingredients and traditional drugs used for new indications, proof of effectiveness has to be provided as per the Act.

Why did AYUSH ministry direct licensing authorities to ignore the rule?

The Ayurvedic, Siddha and Unani Drugs Technical Advisory Board (ASUDTAB), an expert body that recommends actions relating to regulation of AYUSH drugs, in a meeting in May 2023 said that Rule 170 could be omitted as amendments in Drugs and Magic Remedies Act – another law to govern such misleading advertisements – were also being taken up by the health and AYUSH ministries.

It is in this context that the AYUSH ministry made its recommendation to ignore the rule.

LONGER VERSION ON
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Context: The Supreme Court stayed the July 1, 2024 notification issued by the Ministry of Ayush, omitting Rule 170 of the Drug and Cosmetic Rules, 1945 that deals with prohibition of advertisements of Ayurvedic, Siddha and Unani drugs without licensing authority's approval.

Rule 170

- **Introduced in**: 2018, is designed to prevent misleading advertise- ments of AYUSH products.
- **Objective**: To regulate the manufacture, storage, and sale of medicines in India, specifically targeting the control of inappropriate advertisements of Ayurvedic, Siddha, and Unani medicines.
- **Advertisement Prohibition**: Rule 170 prohibits AYUSH drug manufacturers from advertising their products without obtaining prior approval and a unique identification number from the state licensing authority.
- **Submission Requirements**: Manufacturers must submit comprehensive details, including textual references, the rationale for the medicine from authoritative books, indications for use, and evidence of safety, effectiveness, and quality.
- **Grounds for Rejection:** Applications will be rejected if manufacturers fail to provide contact details, if the advertisement contains obscene or vulgar content, promotes products for the enhancement of sexual organs, includes testimonials from celebrities or government officials, refers to any government organization, or makes misleading or exaggerated claims.
- **Reason for Introduction**: Rule 170 was introduced following concerns raised by a parliamentary standing committee about the problem of misleading claims and the need for the AYUSH ministry to take proactive measures on this issue.

Challenges to Regulate AYUSH Drugs

- **Licensing Requirements**: AYUSH drug manufacturers, like those of allopathic medicines, must seek a license from the drug controller.
- **Absence of Clinical Trials:** Unlike allopathic medicines, AYUSH drugs do not require phase I, II, and III clinical trials or equivalence studies for approval.
- **Effectiveness Proof Requirement**: Drugs containing the specified ingredients or traditional drugs used for new indications must provide proof of effectiveness as per the Act.

ANTI-DUMPING DUTY
(Syllabus: GS Paper 3 – Economy)

India trade ministry proposes anti-dumping duty on Chinese aluminium foil imports

Context: The Ministry of Commerce and Industry has recommended imposing an anti-dumping duty on aluminium foil imported from China.

Anti-Dumping Duty

- **About:** It is imposed when imported goods are priced at less than the normal price charged in the exporter's domestic market.
  - It is an instrument to ensure fair trade and is not just a measure of protection per se for the domestic industry.
- **Regulatory Authority:** The Department of Commerce recommends the anti-dumping duty, provisional or final.
  - The Department of Revenue in the Finance Ministry acts upon the recommendation within three months and imposes such duties.
- **WTO's Provisions Related to Anti-Dumping Duty:** The use of anti-dumping measures as an instrument of fair competition is permitted by the World Trade Organisation.
- **Validity**: valid for a period of five years from the date of imposition unless revoked earlier.
- **Sunset Review**: can be extended for a further period of five years through a sunset or expiry review investigation.
  - A Sunset review/ expiry review is an evaluation of the need for the continued existence of a program or an agency. It allows for an assessment of the effectiveness and performance of the program or agency.
  - A review can be initiated suo moto or on the basis of a duly substantiated request received from or on behalf of the domestic industry.

Countervailing duty (CVD)

- **About**: It is a specific form of duty that the government imposes in order to protect domestic producers by countering the negative impact of import subsidies. It is thus an import tax by the importing country on imported products.
- **Regulation in India**: In India, the CVD is imposed as an additional duty besides customs on imported products when such products are given tax concession in the country of their origin.
  - It is administered by the Directorate General of Anti-dumping and Allied Duties (DGAD), in the commerce and industry ministry's department of commerce.
  - The department of commerce recommends anti-dumping duty, provisional or final.

Customs duty:

- **About: It** refers to the tax imposed on goods when they are transported across international borders. In simple terms, it is the tax that is levied on import and export of goods. The government uses this duty to raise its revenues, safeguard domestic industries, and regulate movement of goods.

PROJECT NAMAN
(Syllabus: GS Paper 3 – Sci and Tech)

INDIAN ARMY LAUNCHES PROJECT NAMAN: SPARSH-CENTRIC COMMON SERVICE CENTRES ESTABLISHED ACROSS INDIA

Context: The Indian Army recently launched the first phase of Project NAMAN, with General Upendra Dwivedi, Chief of the Army Staff, and President of the Army Wives Welfare Association (AWWA), in attendance.

Project Naman

- **About**: It is designed to provide dedicated support and services to Defence Pensioners, Veterans, and their families.
- **SPARSH Implementation**: Utilizes the SPARSH (System for Pension Administration Raksha) digital system to streamline pension processes and improve accessibility.
- **Collaboration**: Involves a tripartite MoU between the Indian Army's Directorate of Indian Army Veterans, CSC e-Governance India Limited, and HDFC Bank Limited signed in September 2023.
- **Service Range**: Offers SPARSH-enabled pension services, Government to Citizen (G2C) services, and Business to Consumer (B2C) services at a single location.
- **Initial Phase Rollout:** 14 CSCs established in key Indian cities including New Delhi, Jalandhar, Leh, Dehradun, Lucknow, Jodhpur, Bengdubi, Gorakhpur, Jhansi, Secunderabad, Saugor, Guntur, Ahmedabad and Bangalore.
- **Community Impact**: Provides essential care and support not only to veterans but also to the entire resident population of military stations and surrounding localities.
- **Village Level Entrepreneurs (VLEs)**: Managed by VLEs selected from veterans or Next of Kin (NOKs), who are trained by CSC e-Governance India Limited.
- **Financial Support for VLEs**: HDFC Bank provides VLEs with a ₹20,000 monthly grant for the first 12 months to aid in the centres' stabilization and sustainability.

DECCAN HERALD

Sep 1

FOOT-AND-MOUTH DISEASE (FMD)

(Syllabus: GS Paper 3 – Sci and Tech)

Centre plans FMD-free zones in eight states to enhance animal product exports

Context: The Union government has decided to establish foot-and-mouth disease-free zones across eight states, including Karnataka, Tamil Nadu, Andhra Pradesh, Telangana, Uttarakhand, Punjab, Haryana, Maharashtra, and Gujarat.

- **Transmission**
  - **Excretions and Secretions**: FMD is present in all excretions and secretions from infected animals.
  - **Aerosol Transmission**: A large amount of aerosolized virus is expelled by infected animals, which can infect others via respiratory or oral routes.
  - **Mortality Rates:** FMD is rarely fatal in adult animals but can have high mortality rates in young animals.
- **Symptoms**: FMD is marked by fever and blister-like sores on the tongue, lips, mouth, teats, and between hooves.
  - The disease can cause severe production losses and leave animals weakened even after recovery.
- **Official Status Recognition**: FMD was the first disease for which the World Organisation for Animal Health (WOAH) established official status recognition.
- **Vaccination**: Vaccines are available but must be matched to the specific type and subtype of the virus causing the outbreak.

Foot-and-Mouth Disease (FMD)

- **About:** It is a severe, highly contagious viral disease of livestock that has a significant economic impact.
- **Affected Species:** The disease impacts cattle, swine, sheep, goats, and other cloven-hoofed ruminants but does not affect horses, dogs, or cats.
- **Susceptibility**: Intensively reared animals are more susceptible to FMD compared to traditional breeds.
- **Transboundary Animal Disease**: FMD is a transboundary animal disease (TAD) that disrupts livestock production and regional and international trade.
- **Human Health**: FMD does not pose a threat to human health or food safety and is unrelated to hand, foot, and mouth disease, a different childhood illness.
- **Caused by**: An aphthovirus from the family Picornaviridae.

INDIA TODAY Sep 1

BONDA TRIBE

(Syllabus: GS Paper 1 – Indian Society)

Odisha teen from Bonda tribe cracks NEET, first from community to study MBBS

Context: Recently, a 19-year-old student cracked the National Eligibility-cum-Entrance Test (NEET), who is set to become the first member of the Bonda tribal community.

Bonda Tribe

- **Location**: The Bondas are exclusively found in Malkangiri district of Odisha and are mostly concentrated in Khairaput block of the district.
- **Tribal Status**: They are a particularly vulnerable tribal group and one of the oldest tribes of India.
- **Also known as**: Bondo, Bondas, Bonda Paraja, and Bhonda.
- **Linguistic Group:** They belong to the Austro-Asiatic racial stock and speak Remo, an Austro-Asiatic dialect.
- **Cultural Divisions:** The Bondas are divided into two groups due to their distinct cultural practices:
  - **Lower Bondas**: Reside in the Malkangiri district in south Odisha, bordering Andhra Pradesh and Chhattisgarh.
  - **Upper Bondas**: Live in the remote villages of the district's hilly terrain.
- **Their dressing style is quite unique**:
  - **Women**: Semiclads and adorned with various rings and pieces of jewelry; they traditionally avoid covering their upper bodies, using heavy necklaces and a short loincloth called Nadi.
  - **Men**: Wear a narrow strip of loincloth and use distinctive adornments.
- **Occupation**: They are primarily farmers but also engage in hunting, gathering forest products, and performing labor.



DTE Sep 1

FLUOXETINE
(Syllabus: GS Paper 3 – Sci & Tech)

Pharmaceutical pollutants altering fish behaviour, reproductive patterns and life history: Study

Context: A recent study has shown that prolonged exposure to **fluoxetine (Prozac)** can significantly disrupt the behavior and reproductive traits of male guppy fish.

Fluoxetine

- **About**: Fluoxetine is a widely used medication for treating depression, panic, anxiety, and obsessive-compulsive symptoms.
- **Mechanism of Action**: It works by inhibiting the uptake of serotonin by nerve cells, which helps alleviate symptoms of these conditions.
- **Effects of High Fluoxetine Concentrations:**
  - **Impact on Guppy Fish**: At low concentrations, fluoxetine decreases activity levels and increases refuge-seeking behavior in male guppies.
    - ✓ Guppy fish referred to as the millionfish or rainbow fish and is among the most widely distributed tropical fish globally, as well as one of the most popular freshwater aquarium species.
  - **Dose-Specific Effects**: High fluoxetine concentrations lead to increased variation in body condition, while low concentrations affect sperm numbers.
  - **Importance of Individual Responses**: This highlights the need to consider individual-level responses to pollution, as population-level effects might differ.
  - **Changes in Pace of Life Syndromes:** Fluoxetine alters biological and behavioral traits, suggesting that higher activity levels in polluted waters could be energetically costly and detrimental to health.
  - **Reproductive Behavior**: Larger reproductive organs are associated with lower sperm quality, indicating that pollution may disrupt reproductive behavior and success.

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IMPORTANT SECTIONS OF PMLA ACT

(Syllabus: GS Paper 3 – Internal Security)



How SC has centred rights of the accused in recent PMLA cases

AJOY SINHA KARPURAM
NEW DELHI, SEPTEMBER 1

IN A series of decisions, the Supreme Court has highlighted the rights of people accused of money laundering, even in the face of stringent provisions on arrest and bail under the Prevention of Money Laundering Act, 2002 (PMLA).

In *Vijay Madanlal Choudhary v. Union of India* (2022), a three-judge bench led by Justice A M Khanwilkar (retired) upheld all the challenged PMLA provisions, including the restrictive bail conditions and the wide powers of investigation and arrest granted to the Enforcement Directorate (ED). These powers have been recently reined in through smaller interventions.

On grounds of arrest

Section 19 of the PMLA gives the ED the power of arrest if the material it possesses gives it reason to believe an individual is guilty of money laundering. The accused must be informed of the grounds of arrest "as soon as may be". In *Vijay Madanlal*, the court held that the ED is not bound to supply the accused with a copy of the Enforcement Case Information Report (similar to an FIR), and is only bound to inform them of the grounds for arrest.

The SC detailed the issue in *Pankaj Bansal v Union of India* (2023). It found that the grounds were informed orally in some cases and in writing in others. The court said an accused has a fundamental right to be informed of the grounds of arrest under Article 20 of the Constitution of India. Written grounds of arrest must be given "as a matter of course and without exception", it held. Without this, the arrest would be illegal and invalid.

On bail for undertrials

Section 436A of the Code of Criminal Procedure, 1973, states that if a person has been detained for up to half the maximum period of imprisonment for that offence while the trial or investigation is underway, they shall be released on bail. In *Vijay Madanlal*, the bench held that this would apply to PMLA as well.

On May 16, the court affirmed this in *Ajay Ajit Peter Kerkar v Directorate of Enforcement*. Notably, Section 436A has since been replaced by Section 479 of the Bharatiya Nagarik Suraksha Sanhita, likely impacting PMLA cases. For example, a new explanation in the section states that if more than one offence or multiple cases are pending against someone – common in money laundering cases – the section on bail will not apply.

EXPLAINED LAW

On 'need and necessity to arrest'

On July 12, the apex court granted interim bail to Delhi Chief Minister Arvind Kejriwal in connection with the ED's complaint in the Delhi excise policy case. Kejriwal argued that his arrest under Section 19 of the PMLA was illegal as there was no "necessity" to arrest him. He claimed that the material forming the basis of his arrest was available to the ED in July 2023, while the arrest only happened in March 2024.

As Section 19(1) provides that the ED must have "reason to believe" that the accused is "guilty", the court stated that these reasons must meet a high threshold and effectively be in the form of "evidence admissible in court".

The court also referred the issue of whether "need and necessity to arrest" is a valid ground for challenging an arrest under the PMLA to a five-judge bench.

On relaxing 'twin conditions'

On August 9, a bench comprising Justices B R Gavai and K V Viswanathan granted bail to former Delhi Deputy CM Manish Sisodia in the Delhi excise policy case.

Section 45 of the PMLA provides stringent "twin conditions" for bail, requiring an accused to prove that he has not committed an offence under the PMLA (reversing the standard burden of proof in criminal cases) and is not likely to commit any offence while on bail. However, the bench held that these conditions can be "relaxed" if the accused has undergone a long period of incarceration. Sisodia was incarcerated for around 17 months without trial commencing.

On bail exception for women

The court granted bail to BRS leader K Kavitha on August 27 in the excise policy case. It also held that Kavitha would benefit from the exception in Section 45, which states that a woman "may be released on bail, if the Special Court so directs".

The bench rejected the Delhi HC's reasoning for denying bail to Kavitha in July because she was "well educated" and could not be considered a "vulnerable woman" under the exception. It held the judge "totally misdirected herself" while denying the benefit.

On confession to ED officer

Section 50 of the PMLA allows the ED to summon "any person" and require them to make statements during an investigation. In *Vijay Madanlal*, the court held that this did not violate the right against self-incrimination under Article 20(3) of the Constitution.

Under Section 25 of the Evidence Act, 1872 (now Section 23 of the Bharatiya Sakshya Adhiniyam, 2023), confessions made to police officers are not admissible as evidence during trial.

In *Prem Prakash v Union of India* (2024), the bench comprising Justices Gavai and Viswanathan dealt with a case where an accused admitted guilt while in judicial custody. Justice Viswanathan reasoned that a person in custody is "not a person who can be considered as one operating with a free mind". He also relied on past SC judgments, which held that evidence through "compelled testimony", obtained through coercive methods, would violate the right against self-incrimination.

Context: In a series of decisions, the Supreme Court has highlighted the rights of people accused of money laundering, even in the face of stringent provisions on arrest and bail under the **Prevention of Money Laundering Act, 2002 (PMLA).**

Important Sections Related to Arrest and Bail

- **Section 19 of the PMLA:** It gives the ED the power of arrest if the material it possesses gives it reason to believe an individual is guilty of money laundering. The accused must be informed of the grounds of arrest "as soon as may be".
- **Section 19(1) of the PMLA:** It provides that the ED must have "reason to believe" that the accused is "guilty", the court stated that these reasons must meet a high threshold and effectively be in the form of "evidence admissible in court".
- **Section 45 of the PMLA**: It provides stringent "twin conditions" for bail, requiring an accused to prove that he has not committed an offence under the PMLA (reversing the standard burden of proof in criminal cases) and is not likely to commit any offence while on bail.
- **Section 50 of the PMLA**: It allows the ED to summon "any person" and require them to make statements during an investigation.
- **Section 25 of the Evidence Act, 1872 (now Section 23 of the Bharatiya Sakshya Adhiniyam, 2023)**: It confessions made to police officers are not admissible as evidence during trial.
- **Section 436A of the Code of Criminal Procedure, 1973:** It states that if a person has been detained for up to half the maximum period of imprisonment for that offence while the trial or investigation is underway, they shall be released on bail.
- **Section 479 of the Bharatiya Nagarik Suraksha Sanhita**: It states that if more than one offence or multiple cases are pending against someone common in money laundering cases the section on bail will not apply.

Important Judgements

- **Vijay Madanlal Choudhary v. Union of India (2022)**: a three-judge bench led by upheld all the challenged PMLA provisions, including the restrictive bail conditions and the wide powers of investigation and arrest granted to the Enforcement Directorate (ED).
  - The court held that this did not violate the right against self-incrimination under Article 20(3) of the Constitution.
- **Pankaj Bansal v Union of India (2023):** It found that the grounds were informed orally in some cases and in writing in others. The court said an accused has a fundamental right to be informed of the grounds of arrest under Article 20 of the Constitution of India.

THE HINDU Sci II/Sep 1

CANCER CELLS & TREATMENT

(Syllabus: GS Paper 3 – Sci and Tech)

IACS scientists discover a new target for cancer treatment

A combination of inhibitors that target different aspects of cell cycle and DNA replication makes it hard for cancer cells to survive, thereby enhancing the overall effectiveness of the treatment

R. Prasad

Using human breast cancer cells, a team of scientists at the Kolkata-based Indian Association for the Cultivation of Science (IACS) has discovered a new target for killing cancer cells, which can potentially lead to new therapies. This target is used by cancer cells to regulate DNA repair during cell division. The results of the study were published recently in *The EMBO Journal*.

The work sheds light on how cancer cells respond to topoisomerase I-targeted chemotherapy, including how cancer cells sometimes develop resistance to treatment using their intrinsic DNA repair toolbox. These insights could pave the way for precision medicine approaches for cancer patients.

Developing novel anti-cancer therapeutics may become possible through a combinatorial targeting of two key molecules – the CDK1 protein and the TDP1 enzyme. Present anti-cancer drugs – camptothecin, topotecan, and irinotecan – target a molecule (the enzyme topoisomerase I or Top1) involved in DNA metabolic processes like replication and transcription. The role of DNA topoisomerase I is critical for mitosis as it relaxes the DNA supercoil generated in the condensed chromosomes due to transcription.

"For the past decade at IACS, we have been investigating DNA repair pathways that provide resistance to camptothecin and its clinical derivatives," says Dr. Benu Brata Das, Professor at the School of Biological Sciences at IACS and the corresponding author of the paper.

"Our goal is to uncover new methods to target and eliminate these pathways through targeted or personalised chemotherapy, especially in breast and ovarian cancer. We are currently using mouse models to test the combination drug therapies using *in vivo* tumours."

Treatment strategies

Top1, an enzyme found in all higher organisms, plays a crucial role in maintaining the DNA structure during replication and transcription. Drugs that target Top1 disrupt its activity, leading to the death of many cells, including cancer cells. However, cancer cells can activate repair mechanisms using a protein called TDP1, which counteracts the effect of the drug.

Understanding the overexpression of various DNA repair proteins like Top1, TDP1, or CDK1 in cancers can provide critical insights into tumour biology.

These can help in diagnosing and predicting cancer outcomes and guide the development of targeted and personalised treatment strategies. Knowing these biomarkers is essential for advancing cancer therapy, understanding resistance mechanisms, and improving patient outcomes, says Dr. Das.

The researchers at IACS have identified a key DNA repair protein – TDP1 – which plays a role in repairing DNA damage in cancer cells. Their study shows that cells switch their repair tools depending on the stage of the cell cycle and the presence of a drug called camptothecin that is used in chemotherapy. They discovered that a specific change (phosphorylation) in TDP1 helps remove the TDP1 from the chromosomes during cell division. This finding is important because it helps explain how cells accurately divide and how problems in this process can lead to cancer.

The study suggests that targeting another protein (CDK1) can disrupt the Top1-mediated DNA damage-associated repair process, potentially killing cancer cells by causing chromosomal instability and stopping cell division. "We discover a new mechanism where we show CDK1 directly regulates TDP1 through chemical fine tuning to repair DNA breaks generated by camptothecin, during mitosis thus offering resistance to chemotherapy," says Srijita Paul Chowdhuri, the first author of the paper.

CDK1 inhibitors – avotaciclib, alvocidib, ronicliclib, riviciclib, and dinaciclib – are currently in various stages of clinical trials. These inhibitors can be used alone or in combination with other DNA-damaging agents. Combining CDK1 inhibitors with Top1 inhibitors may have a powerful effect on cancer cells, the study finds.

While Top1 inhibitors cause DNA damage, the CDK1 inhibitors prevent the repair of this damaged DNA or stop the cell cycle. This combination makes it very hard for cancer cells to survive and can enhance the overall effectiveness of the treatment by targeting different aspects of the cell cycle and DNA replication.

Evading treatment

"Cancer cells often develop resistance to single-agent therapies through various mechanisms, such as improved DNA repair pathways or changes in the cell cycle regulation. By using both Top1 and CDK1 inhibitors together, this resistance can be overcome, making it less likely for cancer cells to evade treatment," says Dr. Das.

"Since the rate of proliferation is higher in the case of cancer cells, there are higher chances of the combination drug being taken up by cancer cells," says Dr. Das. "The personalised approach of combinatorial chemotherapy will effectively kill cancer cells by bypassing induced chemoresistance. More studies are needed to confirm the lab results," he says.

The first step towards targeted chemotherapy

IACS researchers have discovered a new target for killing cancer cells

- The new target that has been discovered is used by cancer cells to regulate DNA repair during cell division
- Cancer cells can develop resistance to treatment by using intrinsic DNA repair mechanisms
- A combinatorial targeting of two key molecules — the CDK1 protein and the TDP1 enzyme — may lead to novel anti-cancer therapeutics
- Currently, anti-cancer drugs target a molecule (Top1) involved in DNA replication and transcription
- While drugs that target Top1 can disrupt its activity leading to the death of cancer cells, cancer cells can activate their repair mechanisms to counteract the drug effects
- Targeting another protein (CDK1) that disrupts the Top1-mediated repair process can potentially kill the cancer cells



IACS researchers are currently using mouse models to test the combination drug therapies using in vivo tumours.

- Combining CDK1 inhibitors with Top1 inhibitors can prove lethal for cancer cells

Context: Using human breast cancer cells, a team of scientists at the Kolkata-based Indian Association for the Cultivation of Science (IACS) has discovered a new target **(CDK1 protein and the TDP1 enzyme)** for killing cancer cells, which can potentially lead to new therapies.

New Target for Killing Cancer Cells

- **About**: Developing novel anti-cancer therapeutics may become possible through a combinatorial targeting of two key molecules — the CDK1 protein and the TDP1 enzyme.
- **Current Anti-Cancer Drug Targets**: **Camptothecin, topotecan, and irinotecan** target the enzyme topoisomerase 1 (Top1), which is involved in DNA replication and transcription.
- **Critical Role of Top1 in Mitosis:** Top1 plays a critical role in mitosis by relaxing DNA supercoils generated during transcription, essential for proper chromosome function.
    - Top1 is crucial for maintaining DNA structure during replication and transcription, and drugs targeting Top1 disrupt this process, killing many cells, including cancer cells.
- **Research Focus**: For the past decade, researchers at IACS have been investigating DNA repair pathways that provide resistance to camptothecin and its derivatives, aiming to develop targeted or personalized chemotherapy, especially for breast and ovarian cancers.
- **Cancer Cells' Resistance Mechanisms:** Cancer cells can activate repair mechanisms using the TDP1 protein, counteracting the effects of Top1-targeting drugs.
- **Role of DNA Repair:** Understanding the overexpression of DNA repair proteins like Top1, TDP1, or CDK1 in cancers can provide critical insights into tumor biology, aiding in diagnosis, prognosis, and the development of targeted therapies.
- **Identification of TDP1 in DNA Repair:** Researchers at IACS identified TDP1 as a key DNA repair protein in cancer cells, discovering that phosphorylation of TDP1 during cell division helps remove it from chromosomes.
- **DNA Repair Process with CDK1 Inhibitors**: Targeting the CDK1 protein can disrupt the Top1-mediated DNA repair process, potentially killing cancer cells by causing chromosomal instability and halting cell division.
- **Synergistic Effects of Combining Inhibitors**: Combining CDK1 inhibitors with Top1 inhibitors may enhance cancer treatment effectiveness by targeting different aspects of the cell cycle and DNA replication, making it harder for cancer cells to survive.

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NAMIBIA

(Syllabus: GS Paper 2 – Places in News)

Why Namibia plans to kill hundreds of its majestic wild animals for meat

ALIND CHAUHAN
NEW DELHI, SEPTEMBER 1

NAMIBIA PLANS to cull hundreds of its most majestic wild animals, including dozens of elephants and hippopotamuses, to provide meat for its 1.4 million people — nearly half the southern African nation's population — who are reeling under the worst drought in a century.

A total 723 animals, including 30 hippopotamuses, 60 buffaloes, 50 impalas, 100 blue wildebeest, 300 zebras, 83 elephants, and 100 elands, a type of antelope, are on the kill list. More than 150 animals have been killed already, and the carcasses have yielded about 63 tonnes of meat.

"This exercise is necessary and is in line with our constitutional mandate where our natural resources are used for the benefit of Namibian citizens," the country's Ministry of Environment, Forestry and Tourism said in a press statement on August 26.

EXPLAINED CLIMATE

What has led to drought in Namibia?

Namibia is located in drought-prone southern Africa, and frequently witnesses such events — it had declared national emergencies because of extreme droughts in 2013, 2016 and 2019. But the ongoing drought has been especially widespread and devastating, Juliane Zeidler, the country director of the World Wildlife Fund in Namibia, told *The New York Times*.

The drought began in Botswana in October 2023, spread and intensified across Angola, Zambia, Zimbabwe, and Namibia, and affects most of southern Africa today, according to a report by the European Commission.

The situation is so bad mainly because of El Niño, a weather pattern associated with extreme heat and dry spells in many parts of the world and the ocean. An El Niño event returned after seven years in 2023, leading to above-average temperatures and minimal precipitation across the region. Severe soil moisture deficits and vegetation stress followed, resulting in drought.



Also, numerous studies have found that with rising temperatures due to climate change, extreme weather events such as droughts and floods have become more frequent and intense.

How has the drought impacted Namibia?

Food availability is usually low in Namibia from July through September, and the situation has been made worse by the drought. Staple crops such as maize have dried up, large numbers of livestock have died, and almost 84% of the country's food reserves are exhausted, a United Nations spokesman said on August 23. As stocks have diminished, prices have skyrocketed, curtailing access to food for a large number of people.



An elephant in Botswana, next door to Namibia. *The NYT*

"Between April and June 2024, an estimated 1.2 million people...in Namibia face high levels of acute food insecurity...and require urgent action to reduce food gaps and protect livelihoods. These are the most vulnerable groups...in both urban and rural areas," the Integrated Food Security Phase Classification (IPC) said in a report in July.

Severe acute malnutrition among children under five has increased, and deaths have been reported in some areas, the United Nations Office for the Coordination of Humanitarian Affairs (OCHA) has said.

OCHA has also flagged the increased vulnerability of women due to the drought: "As women and girls are required to walk longer distances to collect food and water, their risk of being subjected to gender-based violence also increases."

How would the culling of wild animals help?

It is not just for meat that Namibia wants to cull wild animals. The government fears that the drought will force the animals to migrate in search of food and water, which could bring them in conflict with human populations. The country has a significant number of wild animals, including 24,000 elephants, one of the largest populations in the world.

The Ministry of Environment, Forestry and Tourism statement said it also hopes that culling of some animals would reduce the effect of the drought on wildlife. It would help "in managing the current grazing pressure and water availability...in some parks and communal areas where we feel numbers exceed available grazing and water," the ministry said.

Is killing wild animals for meat unusual?

No. Wild animals of various species are hunted for food, sport, or trophies around the world.

Animals such as zebras, blue wildebeest, and impala, which are on Namibia's cull list, are eaten by people in the southern African region, *The NYT* report said.

Rose Mwebaza, director of the United Nations Environment Programme's Africa Office, told *The NYT* that "provided the harvesting of these animals is done using scientifically proven, sustainable methods that consider animal welfare and are in line with both domestic and international commitments and legislation, there should be no cause for concern".

Context: Namibia plans to **cull hundreds of its most majestic wild animals, including dozens of elephants and hippopotamuses,** to provide meat for its 1.4 million people nearly half the southern African nation's population who are reeling under the worst drought in a century.

Namibia

- **About:** It is located on the southwestern coast of Africa.
- **Bordered by:** Angola to the north, Zambia to the northeast, Botswana to the east, South Africa to the southeast and south, and the Atlantic Ocean to the west.
    - It ranges from arid in the north to desert on the coast and in the east.
- **Rivers**: Kunene (Cunene), the Okavango (Cubango), the Mashi (Kwando), and the Zambezi on the northern border and the Orange on the southern.
- **Caprivi Strip:** Namibia has a long, narrow eastern extension (the Caprivi Strip) based on a German misconception that access to the Zambezi—despite the Victoria Falls—meant access to the Indian Ocean.
- **Drought in Namibia:** The drought began in Botswana in October 2023, spread and intensified across Angola, Zambia, Zimbabwe, and Namibia, and affects most of southern Africa today, according to a report by the European Commission.
- Namibia had declared national emergencies because of extreme droughts in 2013, 2016 and 2019.

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