Topics

- Gharial (Gavialis gangeticus)
- What is biodosimetry?
- Five-year climate agenda for India
- poliovirus
- Mains

By saurabh Pandey

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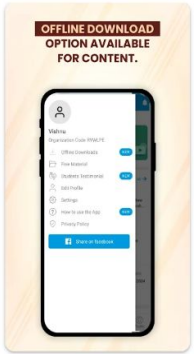

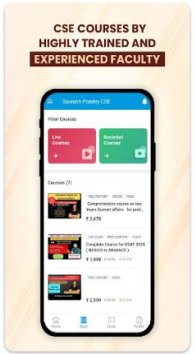

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BY SAURABH PANDEY SIR

Brahmaputra's lone female gharial's long wait for a mate could end soon

Rahul Karmakar
GUWAHATI

A lone female gharial has temporarily overshadowed the one-horned rhino in the Kaziranga National Park and Tiger Reserve in eastern Assam.

Wildlife officials and specialists are not sure how this gharial came to inhabit a stretch of the Brahmaputra within the national park. But they are certain that the reptile, presumed to be an adult by its size, is the key to repopulating the river with gharials.

Distinguished from other crocodilians by its elongated snout, the gharial (*Gavialis gangeticus*) was believed to have been wiped out from the Brahmaputra river system during the 1950s, though there were claims of sightings in the 1990s. The female gharial was first spotted in 2021 within the Biswanath Wildlife Division of the 1,307.49-sq. km Kaziranga.

A comeback: Gharials were believed to have been wiped out from the Brahmaputra river system during 1950s. SPECIAL ARRANGEMENT

The gharial, now 2.55 metres in length, was recorded twice, 500 metres apart, in one of the three priority habits chosen during a 10-day survey of aquatic reptiles along the Brahmaputra in January.

Teams of the Turtle Survival Alliance Foundation India (TSAFI), an NGO specialising in reptiles, and the Assam Forest Department surveyed the Brahmaputra on a 160-km stretch from the Kaliabhomora bridge in the west to the Kamalabari Ghat in Majuli beyond the eastern edge of the Biswanath division.

The female gharial was found to be the only one of its kind moving between a "sandy shoreline" and a "sandbar with a shoreline water depth of 4.5 metres".

"We do not know much about gharials in the Brahmaputra but we do know that this female has been lonely for more than three years and is close to the size of an adult ready to breed," Sushmita Kar, TSAFI's project director in the northeast, told *The Hindu*.

One of the 10 recommendations in the report was the "high-priority" reintroduction of gharials in the Brahmaputra.

Kaziranga's Director Sonali Ghoshsaid the tiger reserve had the right conditions for a gharial breeding programme.

If the reintroduction proposal is approved, the reptiles are likely to be brought from the Kukrail gharial breeding centre near Lucknow.

Gharial (Gavialis gangeticus)

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-

- Gharials were once widely distributed in the large rivers that flow in the northern part of the Indian subcontinent.
- These included the Indus, Ganga, Brahmaputra and the Mahanadi-Brahmani-Baitrani river systems of India, Bhutan, Bangladesh, Nepal and Pakistan.
- They are also thought to have been found in the Irrawady River of Myanmar.
- Today, their major population occur in three tributaries of the Ganga River: the Chambal and the Girwa Rivers in India and the Rapti-Naryani River in Nepal.
- The Gharial reserves of India are located in three States – Uttar Pradesh, Madhya Pradesh and Rajasthan.

Conservation status:

IUCN : Critically Endangered

IWPA : Schedule I

CITES : Appendix I

Radiation biodosimetry: the ABCs of responding to a radiological event

The time required to report the dose is critical, treatments for radiation are more effective the earlier they are administered. It would therefore be beneficial for the assay to produce a same-day result. The team at Columbia is working to reduce assay time, on an HTS platform, to under 4 hours

Guy Garty
Venkatachalam P

After a large-scale radiological event, such as an Improvised Nuclear Device or reactor accident, it is important to identify those individuals who have received a significant dose of radiation and would benefit from one of the drugs that have been recently approved to treat radiation sickness. These drugs are most effective when administered within a few days of exposure. It is also critical to reassure those individuals who have not received a significant dose but are extremely concerned, preventing them from overwhelming hospitals. Thus, there will be a pressing need to assess, within a few days, the radiation doses received by tens or hundreds of thousands of individuals.

What is biodosimetry?

Biodosimetry allows one to determine the amount of radiation to which an individual was exposed based on changes in blood, urine, or hair. It would be particularly useful in a radiological event where the exposed individuals do not carry any personal radiation monitoring devices.

The gold standard biodosimetry assay is measurement of chromosome aberrations, in white blood cells. When irradiated, DNA in the blood cells gets broken and is repaired within a few hours. In some cases, there is an incorrect repair, joining fragments from different chromosomes, forming a 'DicentricChromosome (DC)' - a chromosome with two centromeres. Because a DC can only be formed by radiation, measuring these chromosomes is a specific and sensitive indicator of past radiation exposure. In order to measure DC, lymphocyte from the exposed individuals is cultured to begin division and then the chromosomes are spread on a slide and stained. The DC are then counted either while looking down a microscope directly or in images captured at high magnification. Due to the need for culturing the cells followed by the analysis of few hundred metaphases, the overall time taken to produce a result is about 2-3 days. Over the past decades, the Dicentric Chromosome Assay (DCA) has been successfully employed in many radiation accidents, where the number of exposed people is small. However, as implemented in a clinical cytogenetic lab, the DCA is too labour intensive to be practically applied in a larger event, with a throughput of a few tens of samples per day.

A second, slightly simpler, assay is the Cytokinesis Block Micronucleus Assay (CBMN), where the white blood cells are made to divide, but arrested before division is complete. This forms a cell with two nuclei. Following radiation exposure some DNA will be ejected during division forming a "micronucleus". This assay is slightly simpler to perform and score but overall time to answer is longer (~3 days), as it requires longer culturing of the cells.

Measurement on the phosphorylated form of specific histone protein, an inherent component of chromosomes known as the "gamma-H2AX' assay, has the potential to segregate the exposed from that of unexposed and those exposed to low dose versus high dose without culturing cells, within 6-8 hours of time. This assay needs to be performed within 24 hours owing to the kinetics of histone phosphorylation.

Dr. Guy Garty with Medical Students at the INDO-USA-Sparc Workshop at the Sri Ramachandra,Institute of Higher Education and Research in Porur. VELANKANNI RAJ B

Increasing throughput

The traditional approach to increasing the throughput of biodosimetry assays is to implement a lab network, where samples are shared between a dozen or more labs around the world, however this does not provide a sufficient increase in throughput to cope with a large radiological event.

Over the last 20 years the Center for Radiological Research at Columbia University has developed automatable versions of the major biodosimetry assays, performed in 96-well plates. The use of 96-well plates allows a significant increase in throughput as 96 samples are processed simultaneously.

The first iteration of the Rapid Automated Biodosimetry Tool (RABiT) used custom robotics to perform the CBMN assay with a target throughput of 6000 samples per day per machine. More recently we have implemented both the CBMN and DCA assays on several commercial High Throughput Screening (HTS) platforms, dubbed "RABiT-II". HTS systems use robotics, liquid handling devices and automated microscopes to quickly conduct millions of chemicals, genetic, or pharmacological tests. In the pharmaceutical industry, these systems leverage automation to quickly assay the biochemical activity of many drug-like compounds. In academia, the same systems are increasingly used to arrive at fundamental biological insights rather than drug candidates.

The broad deployment of HTS platforms would allow significantly increased throughput for performing biodosimetry, with each machine capable, in principle, of analyzing thousands of samples per day. A second major advantage is reliability. A commercial system with such diverse deployment capabilities undergoes rigorous quality control during development, manufacture and most importantly maintenance. Indeed, the quality of HTS data is very high and often better controlled than data generated by lower-throughput biological tests. Because these systems are in continuous operation, they also have a broad base of trained users and maintenance personnel ensuring successful operation during a crisis. This would obviously not be the case with a custom robotic system which would likely be in storage for years or decades before use.

> Biodosimetry allows one to determine the amount of radiation to which an individual was exposed based on changes in blood, urine, or hair. It would be useful in a radiological event where the exposed individuals do not carry any radiation monitoring devices

Reducing time to answer

Obviously, the time required to report the dose is critical, many of the treatments for radiation sickness are more effective the earlier they are administered. It would therefore be very beneficial for the assay to produce a same-day result. As they currently exist the DCA and CBMN assays cannot do this, as cells need to be cultured for 2-3 days. The DCA can be significantly accelerated by treating the cells with specific Kinases that cause the chromosomes to condense without the need for culturing. This Premature Chromosome Condensation (PCC) assay can potentially provide a same day dose estimate. The team at Columbia University is currently working to reduce assay time, when implemented on an HTS platform, to under 4h.

Logistics

The US Centers for Disease Control and Prevention (CDC) suggests establishing Community Reception Center (CRC) locations as quickly as possible in the aftermath of a large-scale radiological or nuclear incident, after which the public will be provided with information about CRC locations and will be provided with instructions regarding who should report to which CRC. The CRC itself will include several distinct areas in which persons will be screened for external contamination, decontaminated, if necessary, entered into the long-term tracking system, and discharged with appropriate instructions. In order to cope with the high number of individuals that need to be tested, the U.S. government envisages a two-tier triage scheme: a rapid Point-of-Care (POC) biodosimetry assay and a hospital- or lab-based biodosimetry assay.

The POC test will be administered at the CRC and is meant to provide a binary (exposed/not exposed) answer within 30 minutes but no dose estimate. One candidate POC assay is based on a protein signature using a lateral flow assay, like a Covid test. Individuals found to be unexposed using this test will be sent home (but may be asked to return for follow-up later).

Individuals found to be exposed, using the POC test, will be required to submit to a lab- or hospital-based test, such as DCA or CBMN, implemented ideally on a HTS platform. This test requires more time to perform but can determine dose with higher precision and can be used to assign individuals to treatment categories. For example, individuals who received lower doses would only need observation while a higher dose category would benefit from administration of one of the drugs that were recently approved by the FDA for mitigating radiation sickness. Individuals who have received even higher doses may benefit from a bone marrow transplant.

At a later stage, once all seriously injured individuals have been treated, this test can then be offered to the rest of the population to provide information on long term risks and to identify individuals requiring, for example, increased cancer screenings.

In conclusion, high throughput automated biodosimetry offers the opportunity to perform dose assessment on a large number of people in the event of a large-scale radiological or nuclear incident.

It fits well with the current operation concept, as a 2nd-tier triage separating exposed individuals into treatment categories and later for long-term epidemiological follow-up.

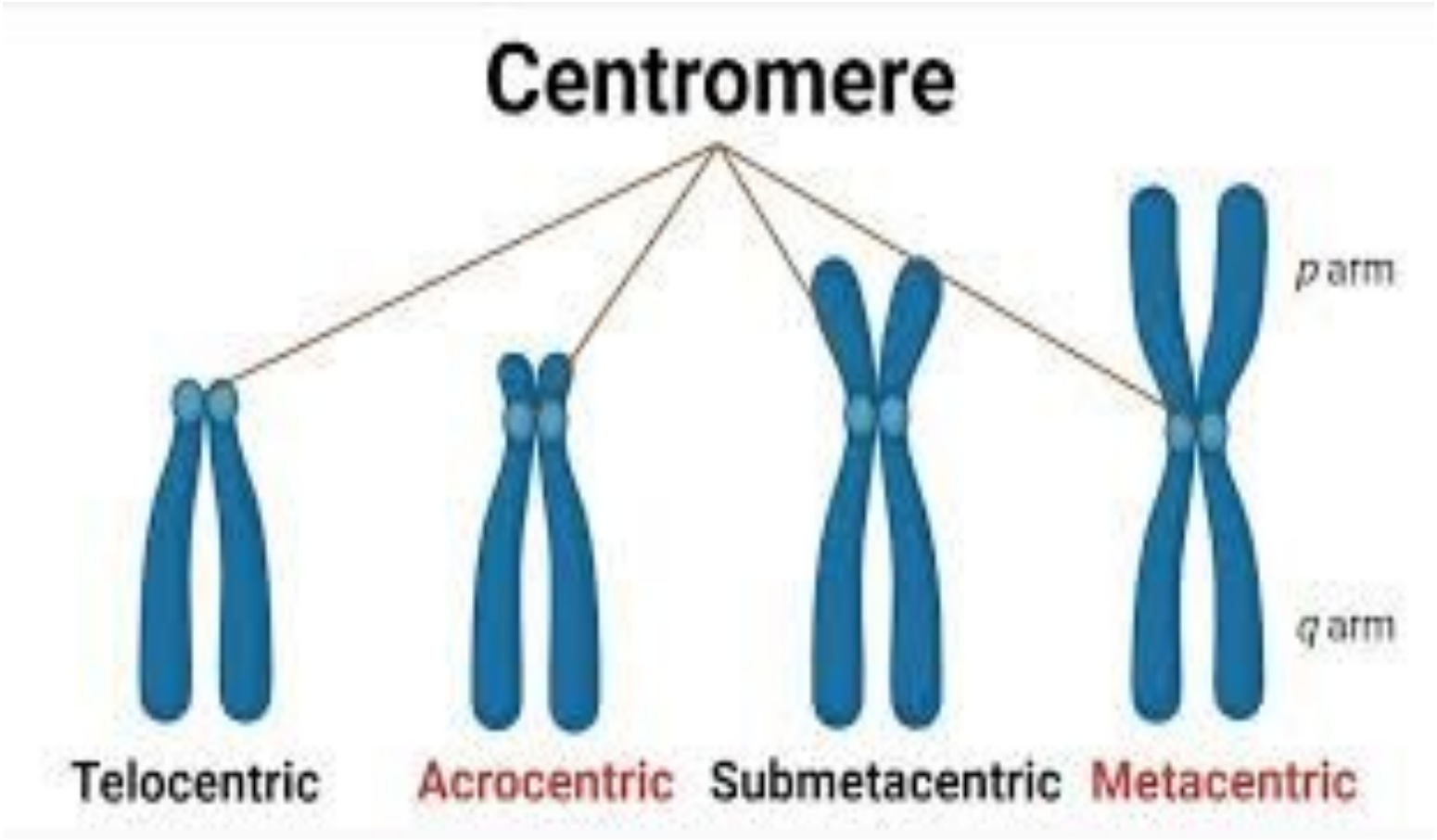
(Dr. Guy Garty is the Director, Radiological Research Accelerator Facility & Associate Professor of Radiation Oncology at CUMC, USA (email: gyg2101@cumc.columbia.edu)

& Dr. Venkatachalam P. is the Professor & Head with the department of Human Genetics & Associate Dean for Research, Sri Ramachandra Institute of Higher Education at Chennai, India(venkip@sriramachandra.edu.in).)

What is biodosimetry?

- Biodosimetry allows one to determine the amount of radiation to which an individual was exposed based on changes in blood, urine, or hair.
- It would be particularly useful in a radiological event where the exposed individuals do not carry any personal radiation monitoring devices.
- The gold standard biodosimetry assay is measurement of chromosome aberrations, in white blood cells.

- When irradiated, DNA in the blood cells gets broken and is repaired within a few hours.
- In some cases, there is an incorrect repair, joining fragments from different chromosomes, forming a ‘DicentricChromosome (DC)’ – a chromosome with two centromeres.
- Because a DC can only be formed by radiation, measuring these chromosomes is a specific and sensitive indicator of past radiation exposure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The shape of a five-year climate agenda for India

As the new government settles in, what it does to scale up climate action will affect every Ministry, new and old, and every sector, big and small. Some of its choices would be pivotal to how India structures its economic path in a sustainable way, positions itself as the voice of the Global South at the right tables, and fights for climate finance and justice over the next five years.

India's transformation

Over the last decade, India has shown significant climate intent and progress on many fronts. It has moved on from being a hesitant participant reacting to developments in the global climate discourse to being a bold leader shaping narratives and institutions. First, it has laid the foundation for global institutions such as the International Solar Alliance, the Coalition for Disaster Resilient Infrastructure, and the Global Biofuels Alliance, as well as shaped the Green Development Pact under its G-20 presidency last year. Second, for the first time, India has started talking about bolder and more ambitious emission mitigation targets. The 2070 net-zero target and ambitious Nationally Determined Contributions (NDC) are milestones. With the net-zero announcement, India has acknowledged the criticality of absolute emission reductions over the near-term relative emissions-intensity-based targets. The net-zero goal has changed the debate domestically with various actors, policymakers and the private sector. Third, sustainability-linked domestic economic policies are no longer on the margins. The creation of an Indian emissions carbon trading scheme, an institution that should operate for at least 30-40 years, is a case in point.

In the next five years, the government must accelerate and show the world that economic development can be sustainable, too. India should follow the mantra of 'go higher, go wider, go deeper' to align its climate leadership with economic prowess.

Vaibhav Chaturvedi

a Senior Fellow at the Council on Energy, Environment and Water (CEEW) and leads its low carbon economy and carbon markets research

The new government should aim to take India's global climate leadership to the next level with a 'higher, wider, deeper' plan

A plan sheet for India

'Go higher' relates to India's global leadership. The country could, sooner or later, host important international climate summits. If it were to host the United Nations Conference of Parties in 2028, it would need to be as successful as the G-20 Presidency. In global negotiations, four years is not that far. Does India want 'the world agrees to no new investment in oil and gas after 2030' as part of the decision text? Does it want a big commitment on adaptation finance so that developing countries can shield themselves against increasing heatwaves, storms, floods and droughts? It takes at least four to five years to achieve consensus on contentious issues. Deciding on what could potentially be the big wins in 2028 and socialising these across countries to stitch alliances and allay concerns must start right away. Alongside, India should continue doubling down on the narrative of equity in international forums, and create leadership space for itself in global institutions that can deliver climate finance.

'Go wider' means India has to adopt and strongly communicate sectoral emission reduction targets that go beyond the power sector. India has achieved significant progress in the power sector and will continue to do so to keep pace with its international non-fossil share-related and domestic renewable energy capacity targets.

The next step is to broaden the target to other sectors. For instance, it could be related to the private mobility space, giving a clear target for zero-carbon two- and four-wheelers. This is not just an urban India project. It will help rural India become mobile, drive jobs in clean energy and sustainability, and promote economic growth. As the last decade has shown, credible policy goals have been powerful signals and forced relevant industries and stakeholders to act. The NDC for 2035, due to be submitted next year, can be an opportunity for going wider with India's energy transition targets.

State-level plans are important

Finally, going deeper implies that sub-national climate action and resilience must come to the fore in this term of the government. Some shoots of this are already visible. The Council on Energy, Environment and Water (CEEW) is working across many States in India to support their net-zero plans through long-term climate and energy modelling. For instance, we collaborated with Tamil Nadu and Bihar for their recently-released plans for a transition towards a net-zero future. The government should think about creating a Centre-State coordination group, incentivising State-level climate actions through the Sixteenth Finance Commission, promoting a deeper integration of scientific modelling capabilities in policymaking, and facilitating a unified data measurement, reporting and verification (MRV) architecture at the State level. Given India's federal structure, this recommendation does not mean centralising climate actions, but ensuring that State-level actions are better coordinated without compromising their autonomy. This is possible only if the process goes beyond States individually trying to understand and respond to the climate crisis, and the Centre comes in as an active facilitator.

The new government should aim to take India's global climate leadership to the next level in its new term. It should look ahead for at least the next four to five years, and not just a year at a time. On most international tables now, India has a seat. It must now demonstrate prowess.

The views expressed are personal

Five-year climate agenda for India

- First, it has laid the foundation for global institutions such as the International Solar Alliance, the Coalition for Disaster Resilient Infrastructure, and the Global Biofuels Alliance, as well as shaped the Green Development Pact under its G-20 presidency last year.
- Second, for the first time, India has started talking about bolder and more ambitious emission mitigation targets.
- The 2070 net-zero target and ambitious Nationally Determined Contributions (NDC) are milestones.

- With the net-zero announcement, India has acknowledged the criticality of absolute emission reductions over the near-term relative emissions-intensity-based targets.
- The net-zero goal has changed the debate domestically with various actors, policymakers and the private sector.
- Third, sustainability-linked domestic economic policies are no longer on the margins.

- **‘Go wider’ means India has to adopt and strongly communicate sectoral emission reduction targets that go beyond the power sector.**
- **India has achieved significant progress in the power sector and will continue to do so to keep pace with its international non-fossil share-related and domestic renewable energy capacity targets.**

- The next step is to broaden the target to other sectors.
- For instance, it could be related to the private mobility space, giving a clear target for zero-carbon two- and four-wheelers.
- This is not just an urban India project.
- It will help rural India become mobile, drive jobs in clean energy and sustainability, and promote economic growth

- **Finally, going deeper implies that sub-national climate action and resilience must come to the fore**

Grave concern

The risk of international spread of wild type-1 polio cases from Pakistan is great

The ambitious goal of eradicating wild-type poliovirus type-1 (WPV1) by 2026 appears to have become tougher. WPV1, which is endemic only in Pakistan and Afghanistan, is showing signs of a resurgence since 2023. With Afghanistan and Pakistan reporting six WPV1 cases each in 2023 – there were two cases in Afghanistan and 20 cases in Pakistan in 2022 – the total incidence of type-1 cases in both countries in 2023 might appear to have nearly halved. But with six cases in Afghanistan and five cases in Pakistan already this year, there appears to be an uptick. If this continues, the total cases being reported from the two countries might be close to or even surpass the 2022 numbers. The concern about WPV1 is not limited to the number of cases in children. The circulation of the virus in the environment is seen to be rising, and, most importantly, after a gap of two years, positive environmental samples have been increasingly collected in Pakistan, in 2023 and till early June this year, from cities which have been historical reservoirs for the virus. Last year, 125 positive environmental samples were collected from 28 districts in Pakistan. Of these, 119 belonged to a genetic cluster (YB3A), which suggests that these were imported from Afghanistan. By June 1 this year, there have been 153 positive environmental samples from 39 districts. As of April 8, 2024, 34 positive environmental samples were collected from Afghanistan.

According to the World Health Organization, the presence of positive environmental samples in "epidemiologically critical areas and historical reservoirs" such as Karachi, Quetta and the Peshawar-Khyber blocks in Pakistan, and Kandahar in Afghanistan, represents a significant risk to the gains made in the past. Rising positive environmental samples are a reflection of polio campaigns not really achieving their desired coverage; fake finger marking sans vaccination is a persisting problem. Though children in Pakistan's cities are largely immunised, there is a heightened risk of the virus striking any unvaccinated or not fully vaccinated children – in 2023, two of the six cases were from Karachi city. The situation in Pakistan appears worse than it is in Afghanistan with the actual spread of WPV1 seen "predominantly in Afghanistan in 2022 now being detected in Pakistan in 2023 and 2024". There is also the grave risk of international spread from Pakistan, particularly to Afghanistan. With over 0.5 million Afghan refugees forced to leave Pakistan, and an estimated 0.8 million to be evicted soon, there is an increased risk of cross-border spread of the virus. There is a large pool of unvaccinated and under-immunised children in southern Afghanistan, increasing the risk that returning refugees can pose.

poliovirus

- Poliovirus containment is focused on eradicated polioviruses. Wild poliovirus type 2 (WPV2) and wild poliovirus type 3 (WPV3) were declared eradicated in 2015 and 2019, respectively.
- There are three types of wild poliovirus (WPV): type 1, type 2, and type 3. People must protect themselves against all three types of the virus to prevent polio disease. Polio vaccination is the best protection.
- Type 2 wild poliovirus was declared eradicated in September 2015.
- The last detection was in India, 1999.
- Type 3 wild poliovirus was declared eradicated in October 2019. It was last detected in November 2012. Only type 1 wild poliovirus remains.

- There are two vaccines used to protect against polio disease: oral polio vaccine and inactivated poliovirus vaccine.
- After wild poliovirus type 2 was declared eradicated in 2015, the world switched from trivalent OPV to bivalent OPV. Bivalent OPV contains poliovirus type 1 and 3.
- This switch means that the bOPV used globally no longer protects against WPV2.

- In rare instances, the vaccine-virus may be able to circulate over time and mutate in communities with insufficient immunity or immunocompromised individuals.
- These mutated OPV strains can cause polio disease.
- They are called poliovirus variants or vaccine-derived polioviruses (VDPVs).

Inactivated poliovirus vaccine

- IPV protects people against all three types of poliovirus. IPV does not contain live virus and cannot cause disease. It protects people from polio disease but does not stop transmission of the virus.
- OPV can be used to contain a polio outbreak. Use of all OPV will stop when polio is eradicated globally. This will prevent re-establishment of transmission from VDPVs.

- Less than 1% of poliovirus infections result in paralysis.
- The virus is most often spread by the faecal-oral route.
- Poliovirus enters through the mouth and multiplies in the intestine. Infected individuals shed poliovirus into the environment for several weeks, where it can spread rapidly through a community, especially in areas of poor sanitation.
- The poliovirus consists of an RNA genome enclosed in a protein shell called a capsid.
- There are three serotypes of wild poliovirus type 1, type 2, and type 3 each with a slightly different capsid protein. Immunity to one serotype does not confer immunity to the other two.

- **T he ambitious goal of eradicating wildtype poliovirus type-1 (WPV1) by 2026 appears to have become tougher.**
- **WPV1, which is endemic only in Pakistan and Afghanistan, is showing signs of a resurgence since 2023. With Afghanistan and Pakistan reporting six WPV1 cases each in 2023 —**

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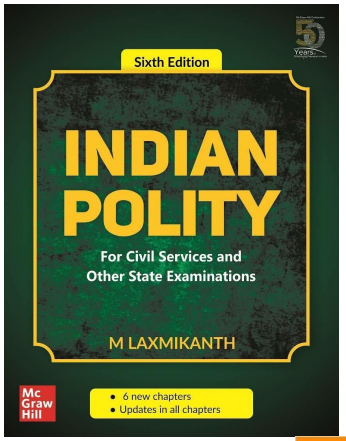

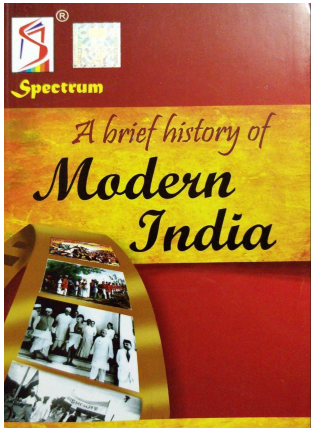

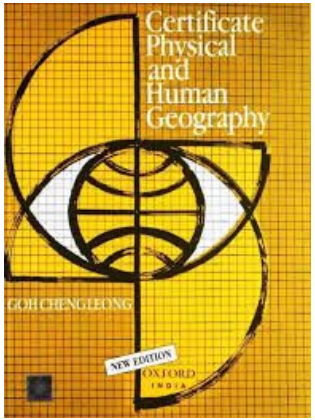

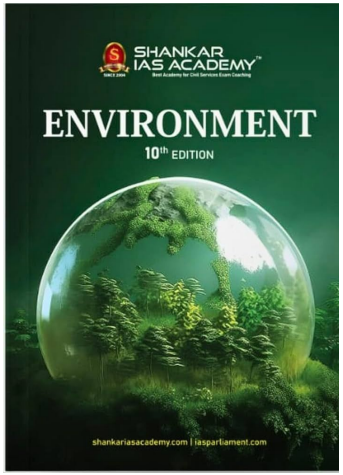

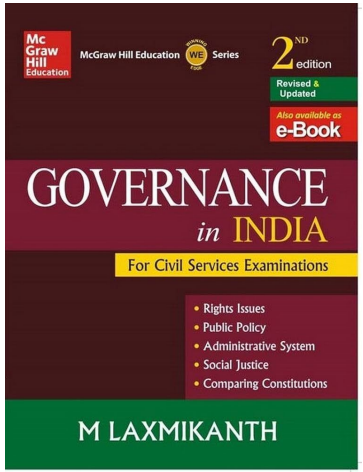

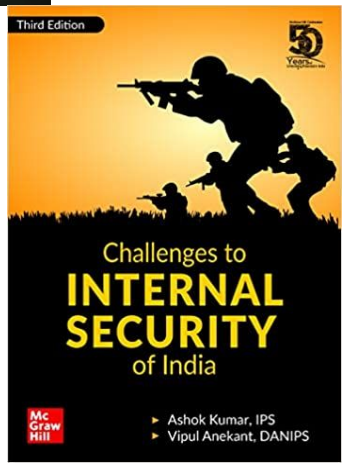

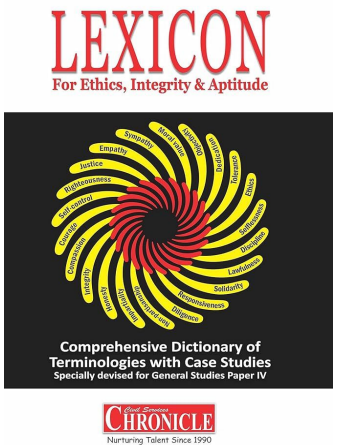

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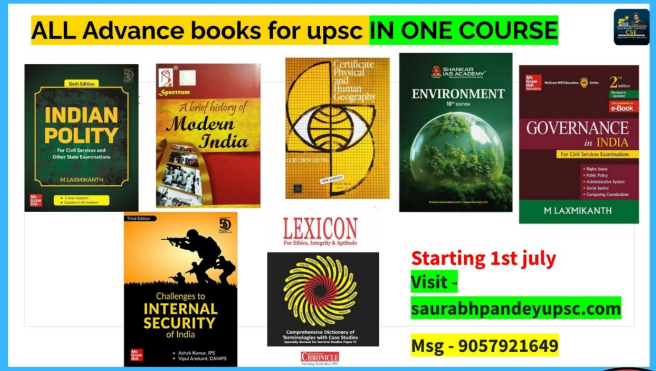

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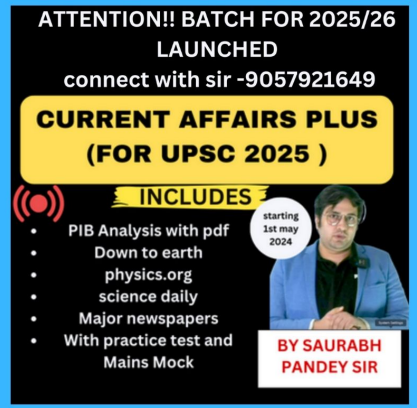

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Target Mains -2024/25 -

Q ‘’ Go Wider ‘’ approach in energy transition is a solution for climate change . Discuss

Q "ऊर्जा परिवर्तन में 'गो वाइडर" दृष्टिकोण जलवायु परिवर्तन का एक समाधान है। चर्चा करना

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send your answer - Saurabh pandey upsc telegram channel