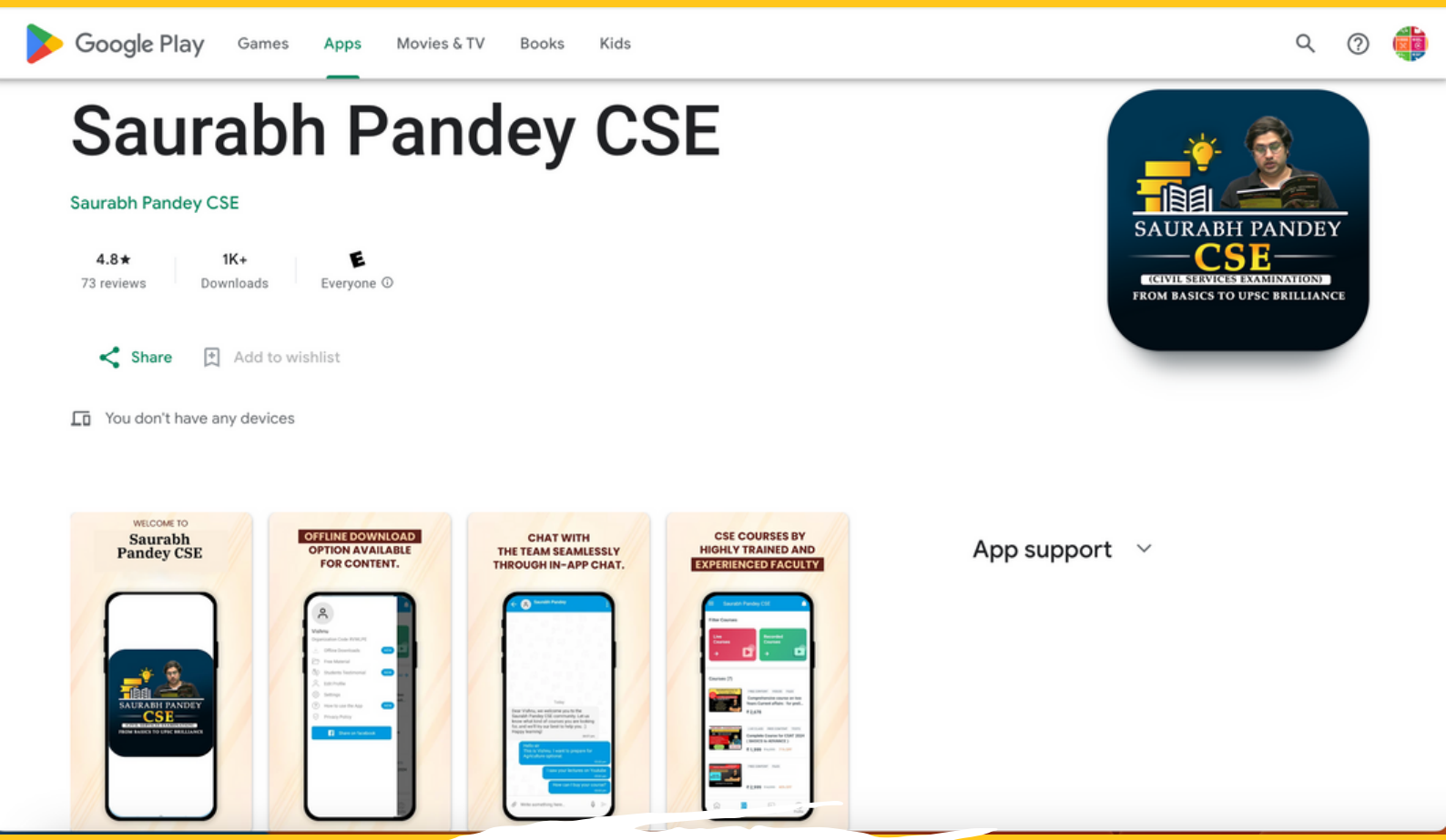
THE HINDU ANALYSIS

17th March 2024

by saurabh pandey

THE HINDU



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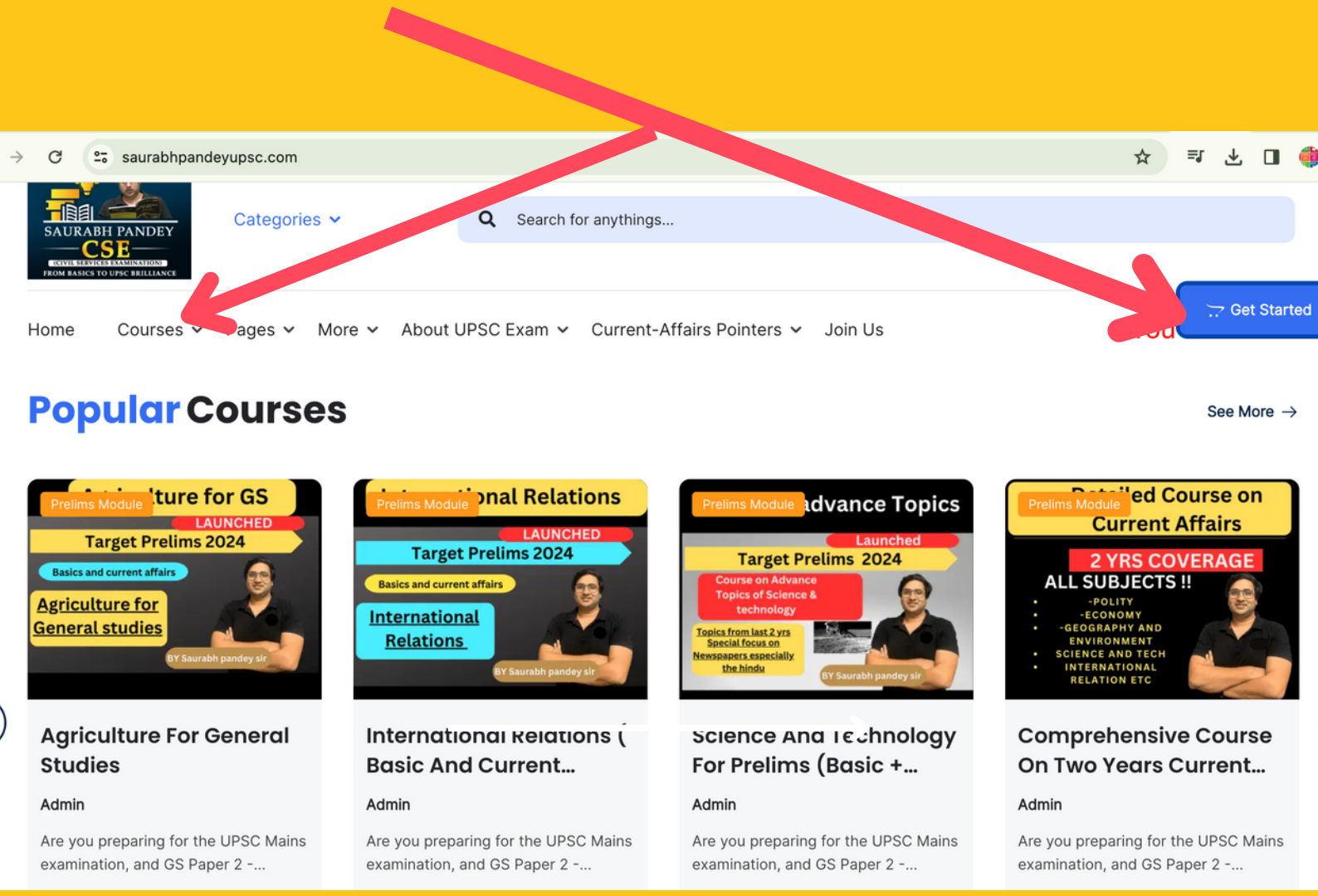

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Cellulose-degrading bacteria in the human gut discovered

Previously undescribed human gut bacteria that aid in the digestion of plant cellulose are scarce in urban societies but abundant in ancient and hunter-gatherer microbiomes, a new study says. Humans rely on the gut microbiome to digest cellulose - the main component of plant fibre and a common element in diets that includes plant-based material. Dietary fibre is beneficial to gut microbiome stability. However, modern industrialised diets, which are dominated by processed foods, are lacking in plant fibre.

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Dietary Breeding

- Human gut bacteria that aid in the digestion of plant cellulose are scarce in urban societies but abundant in ancient and hunter-gatherer microbiomes, a new study says.
- Humans rely on the gut microbiome to digest cellulose – the main component of plant breeding and a common element in diets that includes plant-based material.
- Dietary breeding is beneficial to gut microbiome stability.
- However, modern industrialised diets, which are dominated by processed foods, are lacking in plant breeding .
-

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- In a new study, researchers propose a system to detect viruses in animals that could be less expensive and time-consuming than current methods.
- The high throughput, lensless optical light diffraction technique can detect the ‘fingerprint’ of a viral infection in living cells without the need for expensive reagents or laboratory techniques.
- The approach could open new avenues to test for viruses in livestock and poultry and could inform ways to prevent viral growth and cross-species transmission.
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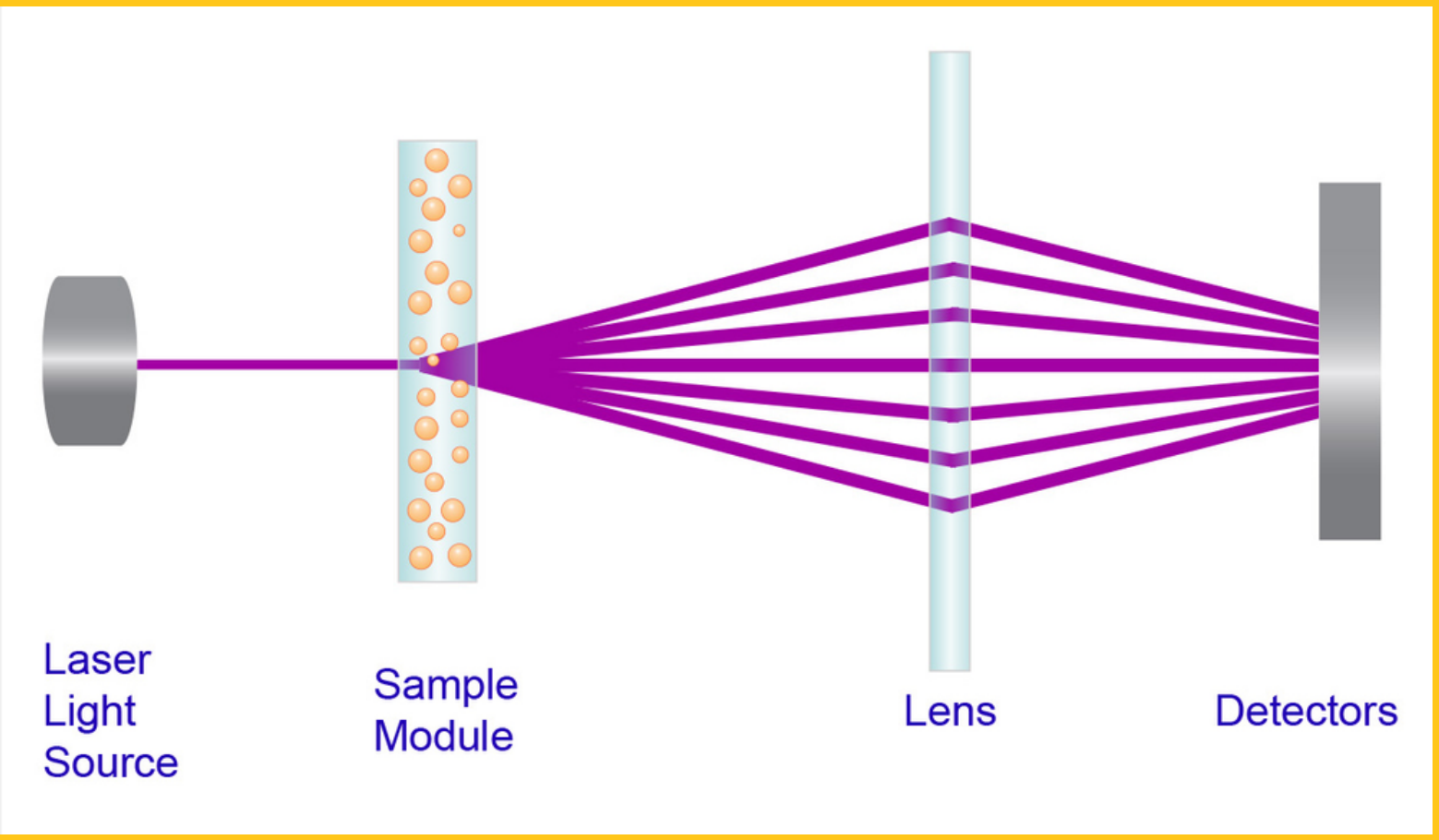

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Starlet sea anemones use a neurotoxin to deter a predator

Starlet sea anemone found along the east coast of North America secretes a specific neurotoxin in its venom that's vital to its defenses against a main predator, the grass shrimp. Nv1 repels the shrimp and also attracts fish that prey on the crustaceans. While Nv1-possessing anemones secreted the neurotoxin into the surrounding water, which strongly repelled shrimp and attracted the fish, when Nv1 was depleted, grass shrimp touched and trampled on the anemone.

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Question Corner

Running speed

Why do medium-sized land animals like cheetahs tend to be the fastest?

While many key traits such as strength, limb length, lifespan and brain size tend to increase with animals' size, maximum running speeds tend to be greatest in medium-sized animals. Empirical data show that maximum running speed increases

The maximum speed an animal can reach is determined by whichever limit is reached first – and that limit is dictated by an animal's size. The maximum running speed is constrained both by how fast muscles contract, as well as by how much they can shorten during a contraction. Animals about the size of a cheetah exist in a physical sweet spot at around 50kg.

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Why do medium-sized land animals like cheetahs tend to be the fastest?

- While many key traits such as strength, limb length, lifespan and brain size tend to increase with animals' size, maximum running speeds tend to be greatest in medium-sized animals.
- Empirical data show that maximum running speed increases up to a critical body mass and then decreases — the fastest runners are of intermediate size.
- The findings suggest that there is not one limit to maximum running speed, as previously thought, but two: how fast versus by how far, muscles contract.

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Cheetah Characteristics

Cheetahs are solitary animals and usually **hunt alone.**

Cheetahs are the fastest land animals, capable of reaching **speeds up to 60-70 miles per hour**.

They have distinctive black **"tear tracks"** running from their eyes to their mouths.

Cheetahs are **agile and excellent climbers**, allowing them to scan for prey from treetops.

Their slender bodies and long legs are designed for quick acceleration and sprinting.

Cheetahs have a limited range, **primarily found in parts of Africa**

ANIMAL LEARNS

- The maximum speed an animal can reach is determined by whichever limit is reached first — and that limit is dictated by an animal's size.
- The maximum running speed is constrained both by how fast muscles contract, as well as by how much they can shorten during a contraction.
- Animals about the size of a cheetah exist in a physical sweet spot at around 50kg, where these two limits coincide.

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Indian team uses repurposed drug to treat oral cancer subtype

In animal studies, the FDA-approved deworming drug was able to significantly inhibit the tumour cells and improve the survival rate in mice carrying the fusion gene-overexpressing cells

R. Prasad

A study by Mumbai-based researchers has successfully identified a novel fusion transcript in head and neck cancer patients. Not only did the researchers find the fusion transcript to be a promising therapeutic target for head and neck cancer but also found

A ray of hope for oral cancer patients

Based on the results of animal studies, clinical trials in oral cancer patients may soon be undertaken

- Researchers from the Advanced Centre for Treatment, Research, and Education in Cancer, Mumbai, have identified a novel fusion transcript in head and neck cancer patients
- In mice studies, they demonstrated that an FDA-approved deworming drug (pyrvinium pamoate) can be a potential drug to treat such

- Mumbai researchers used the drug and discovered it produced significant reduction in the aggressive behaviour of cancer

in the cancer cells also led to reduced proliferation, colony formation ability, and interestingly, a decreased response to pyrvinium pamoate treatment. "This finding highlights the potential effectiveness of targeting the pathway to treat cancers driven by the UBE3C-LRP5 fusion," Dr. Dutta says. The drug was then tested in animal models. In mice, cells overex-

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What is Fusion transcriptome??

- Fusion transcript arises when small segments of two chromosomes exchange their positions leading to structural rearrangement of the chromosomes.
- For instance, a translocation involving chromosomes 6 and 18 will result in chromosome 6 having a small segment of chromosome 18, while chromosome 18 will have a small segment of chromosome 6.
- As a result of the segment exchange between two chromosomes, two different genes are brought together at the point where the segments meet leading to the emergence of a chimeric gene or fusion transcript.

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- In this case, researchers from the Advanced Centre for Treatment, Research, and Education in Cancer (ACTREC), Mumbai were able to identify the fusion transcript (UBE3C-LRP5) as well as map the translocation event to single-base resolution.
- The translocation event involves chromosomes 11 and 7.

A ray of hope for oral cancer patients

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- In mice studies, they demonstrated that an FDA-approved deworming drug (pyrvinium pamoate) can be a potential drug to treat such cancer
- 5.3% of 151 oral cancer patients in India were found to be positive for the fusion transcript
- Of the about 2,00,000 oral cancer patients every year in India, nearly 10,000-11,000 patients may be harbouring the fusion transcript, and may stand to benefit when treated using the deworming drug

Identified: The translocation event involves chromosome 11 and 7

- Mumbai researchers used the drug and discovered it produced significant reduction in the aggressive behaviour of cancer cells harbouring the fusion event
- In mice, the drug was able to significantly reduce the transforming ability of cells expressing the fusion protein and improve the survival rate of the animals
- By targeting the signalling pathway, the drug can stop the progression of cancer and halt the migration and the invasive properties of the cancer cells

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THE HINDU

- Drug repurposing is the technique of using an existing drug or drug candidate for a new treatment or medical condition for which it was not indicated before .
- It was initially developed to treat a different medical condition.
- It has been described as a serendipitous process that happens unexpectedly.
- Drug repositioning involves the investigation of existing drugs for new therapeutic purposes.

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With Agni V test, India makes the MIRV leap

What is the significance of India testing a missile with multiple nuclear warheads that can each hit different targets? Which are the other countries that have MIRV technology?

In the arsenal

Some other ballistic missiles in India's service

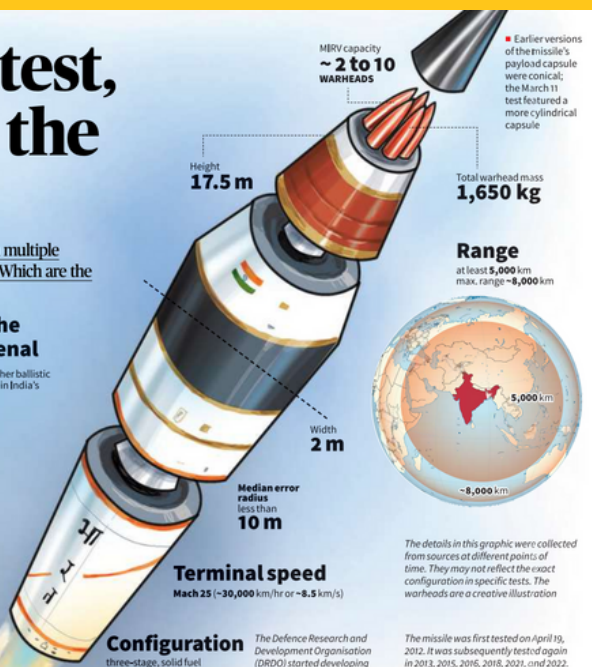
Agni IV
- Launch mass **17 tonnes**
- Payload mass **1,000 kg**
- Range **3,000-4,000 km**

Prithvi II
- Launch mass **At least 4.6 tonnes**
- Payload mass **500-1,000 kg**
- Range **250-300 km**

Sagarika
- Launch mass **6-7 tonnes**
- Payload mass **1,000 kg**
- Range **700-750 km**

Dhanush
- Launch mass **4.5 tonnes**
- Payload mass **250 kg**
- Range **350-750 km**

Note: *Missile range varies by payload mass; dimensions not to scale*



Range

at least **5,000** km
max. range ~**8,000** km

Terminal speed

Mach 25 (~**30,000** km/hr or ~**8.5** km/s)

Configuration

three-stage, solid fuel

The Defence Research and Development Organisation (DRDO) started developing the Agni V missile in 2008, following on from the Agni III

The details in this graphic were collected from sources at different points of time. They may not reflect the exact configuration in specific tests. The warheads are a creative illustration

The missile was first tested on April 19, 2012. It was subsequently tested again in 2013, 2015, 2016, 2018, 2021, and 2022. The latest test was the first for its MIRV capability

Sheena Rani led the project to develop Agni V with MIRV capability. Dr. Rani works at the DRDO Advanced

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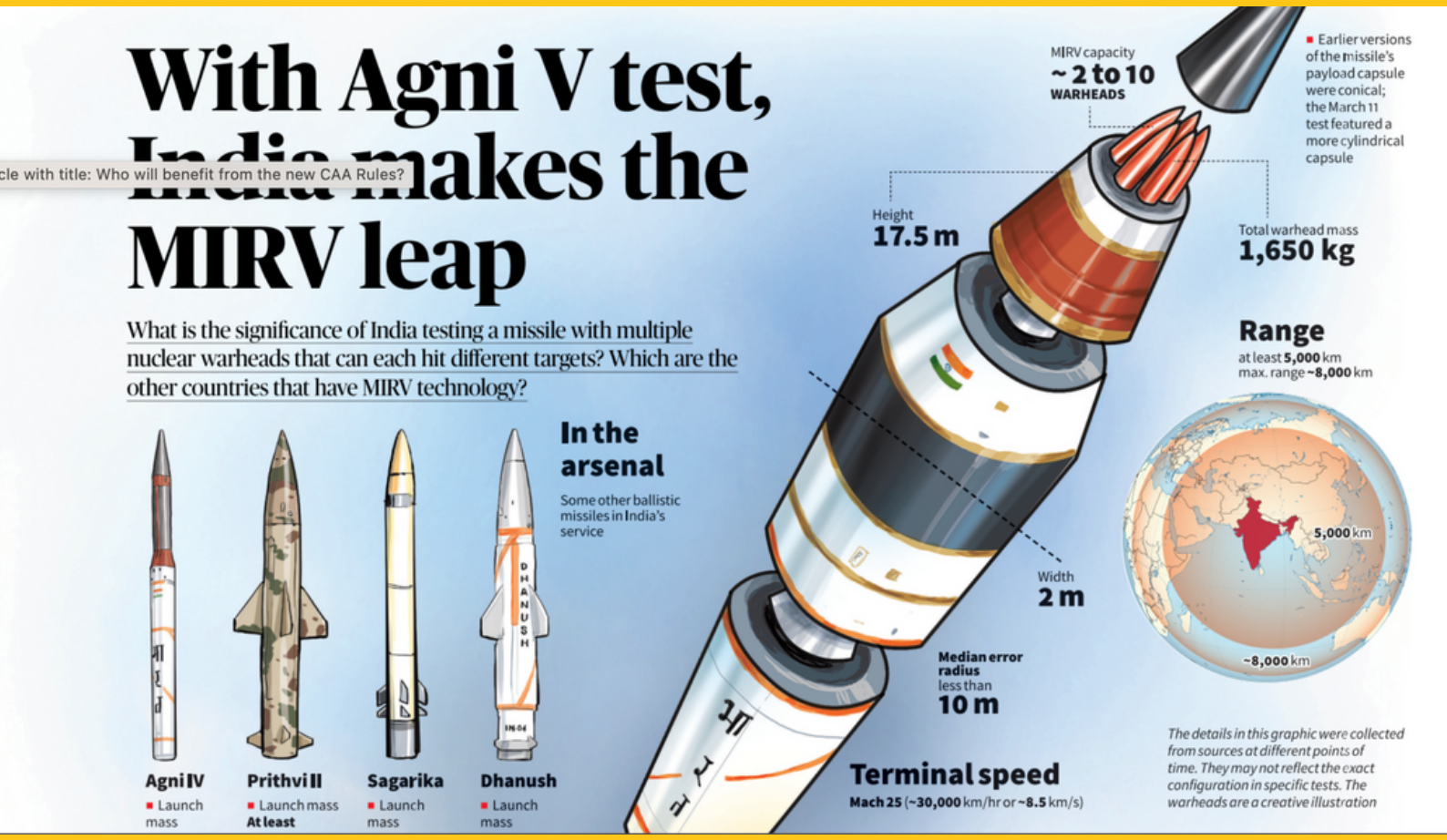

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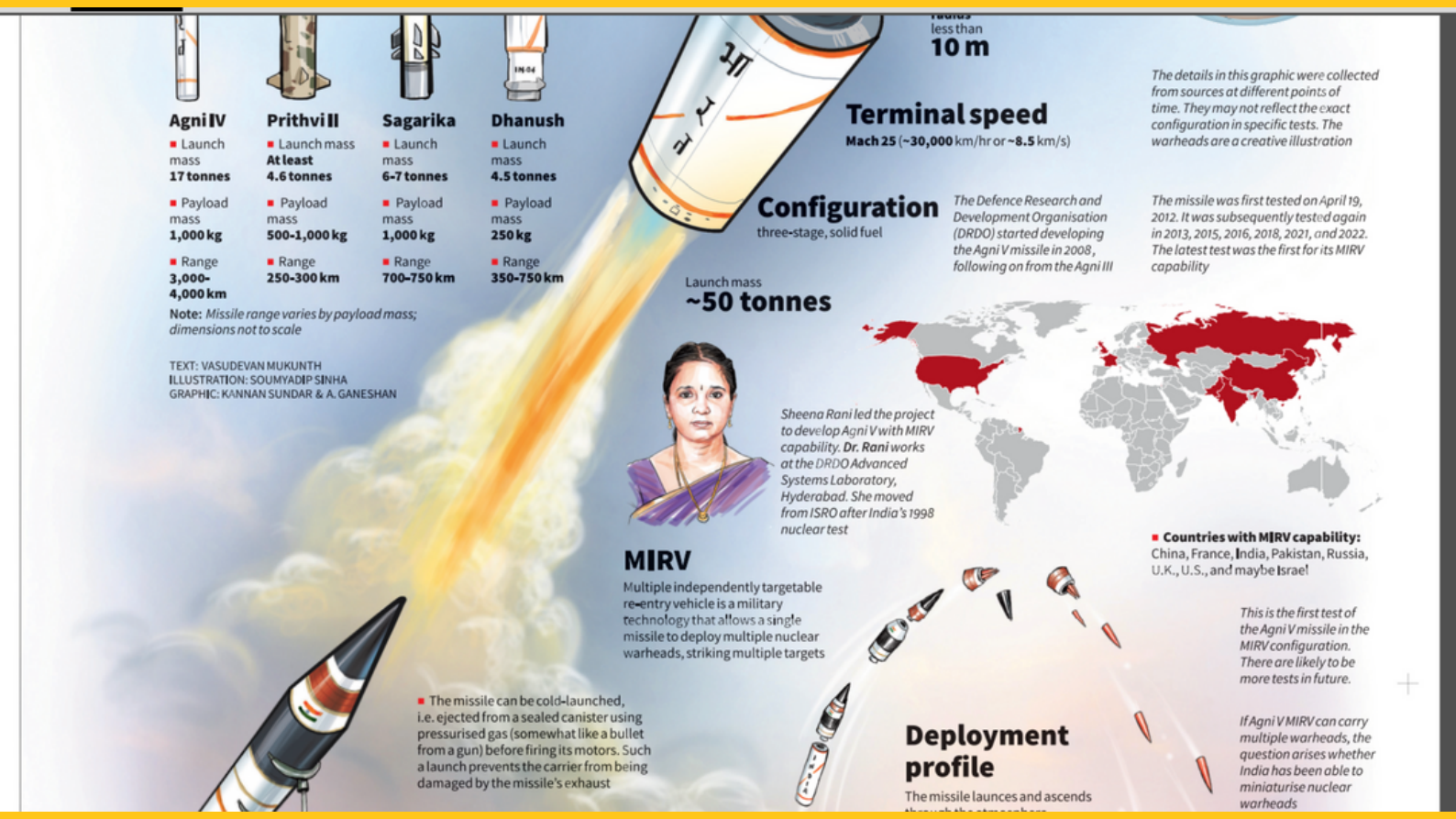
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Launch mass
~50 tonnes
Sheena Rani led the project to develop Agni V with MIRV capability. Dr. Rani works at the DRDO Advanced Systems Laboratory, Hyderabad. She moved from ISRO after India's 1998 nuclear test
Countries with MIRV capability: China, France, India, Pakistan, Russia, U.K., U.S., and maybe Israel
MIRV
Multiple independently targetable re-entry vehicle is a military technology that allows a single missile to deploy multiple nuclear warheads, striking multiple targets
This is the first test of the Agni V missile in the MIRV configuration. There are likely to be more tests in future.
The missile can be cold-launched, i.e. ejected from a sealed canister using pressurised gas (somewhat like a bullet from a gun) before firing its motors. Such a launch prevents the carrier from being damaged by the missile's exhaust
Deployment profile
The missile launces and ascends
If Agni V MIRV can carry multiple warheads, the question arises whether India has been able to miniaturise nuclear warheads

- **What are MIRVs and why are they significant?**
- **A MIRV is a ‘missile bus’ whose passengers are nuclear bombs and which facilitates a single booster to deliver them to different targets, Silky Kaur wrote in an article in Air Power Journal in 2022.**
- **“In 1970, the U.S. started to deploy the Minuteman III, the first MIRV-ed intercontinental ballistic missile (ICBM) with three warheads on each missile.**
- **In 1971, it deployed the Poseidon, the first MIRV-led submarine-launched ballistic missile (SLBM) which had the capability of carrying up to 10 warheads on each missile,” the article added.**
- **The Soviet Union followed the U.S. and by the 1970s developed its own MIRV-ed ICBM and SLBM technology**

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- A Russian MIRV-ed missile under development may be able to carry up to 16 warheads, each in a separate re-entry vehicle, according to the Centre for Arms Control and Non-Proliferation, and some MIRV-ed missiles can hit targets as far as 1,500 km apart.
- The U.K. and France also possess the China has developed and deployed MIRV technology with multiple warheads placed on its DF-5B ICBMs and is fast expanding and modernising its nuclear arsenal. According to Yearbook 2023 of the Swedish think tank Stockholm International Peace Research Institute (SIPRI), China could potentially have at least as many ICBMs as either the U.S. or Russia by the turn of the decade..
-

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.What was the Mission Divyastra test?

- The DRDO conducted the test from Dr A.P.J. Abdul Kalam Island in Odisha, with various telemetry and radar stations tracking and monitoring multiple re-entry vehicles.
- .” Sources said the MIRV system is equipped with indigenous avionics systems and high accuracy sensor packages that ensure the re-entry vehicles reach the target points with the desired accuracy.

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- The ‘Agni’ series of missiles constitute the backbone of India’s nuclear weapons delivery, and Agni V is the longest range missile in the arsenal, with a reach of over 5,000 km.
- This means it can reach most of China, especially with a smaller warhead, which would increase the range further.
- MIRV technology gives better leverage in this regard. Mission Divyastra is significant for several reasons.
- In 1998, India conducted nuclear tests under Pokhran II.
- In 2003, it declared its nuclear doctrine based on a ‘no first use’ (NFU) policy and reserved the right to massive retaliation in case it was attacked first.

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- Based on this, India announced its decision to maintain a minimum credible deterrence and a nuclear triad – comprising aircraft, missiles, and submarines – to deliver these nuclear weapons which has since been completed with ballistic missile submarines of the Arihant class conducting deterrence patrols.
- Specific technical characteristics of the MIRV technology tested are not yet known.
- A MIRV-ed missile enhances the redundancy as a single missile can perform the role of several.
- It can help defeat ballistic missile defences, which is especially important since India's adversaries are deploying sophisticated air defences

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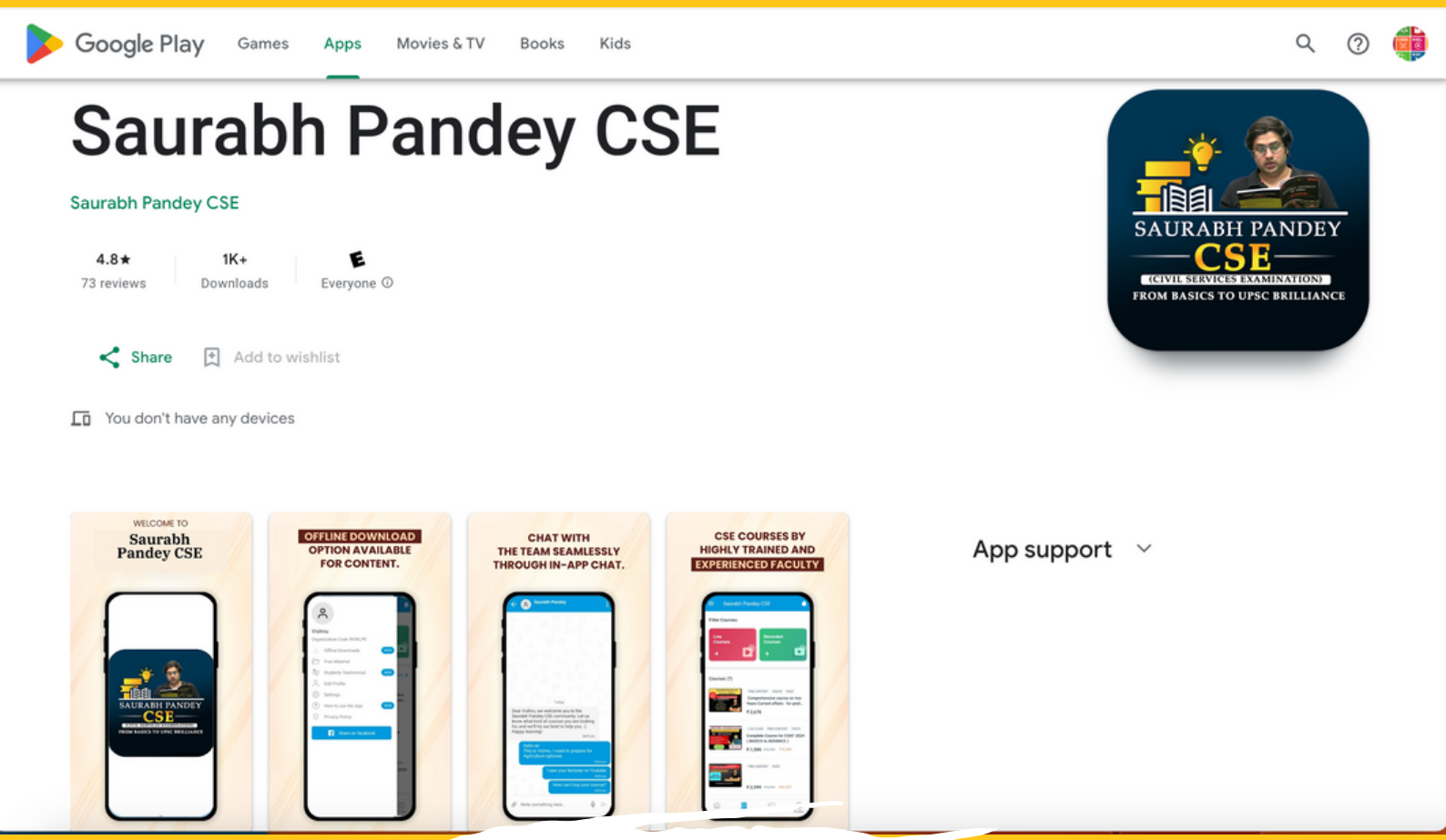

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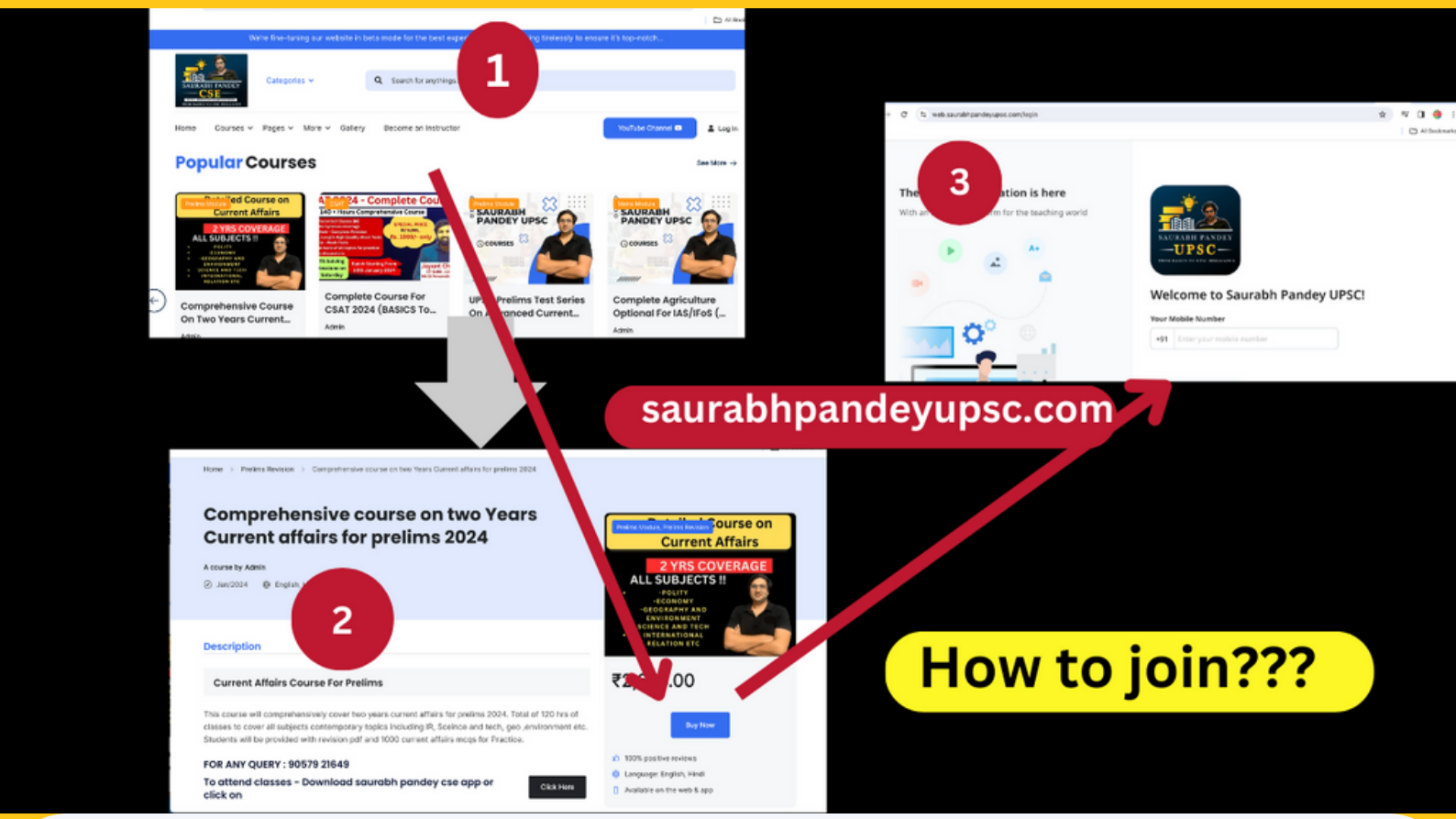

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US RESOLUTION ON AI

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T he United States is spearheading the first United Nations resolution on artificial intelligence, aimed at ensuring that the new technology is “safe, secure and trustworthy” and that all countries, especially those in the developing world, have equal access

The draft General Assembly resolution aims at closing the digital divide between countries and making sure they are all at the table in discussions on AI — and that they have the technology and capabilities to take advantage of its benefits

The draft recognises the rapid acceleration of AI development and use, and stresses “the urgency of achieving global consensus on safe, secure and trustworthy artificial intelligence systems.”

- to develop and support regulatory and governance approaches and frameworks” for safe AI systems.

It warns against “improper or malicious design, development, deployment and use of artificial intelligence systems, such as without adequate safeguards or in a manner inconsistent with international law.”

GELEPHU

Bhutan's plans for a regional economic hub at Gelephu, a town bordering Assam in India, are high on Bhutan Prime Minister Tshering Tobgay's agenda

The plan, launched by Bhutan's King Jigme Khesar Namgyel Wangchuck in December 2023, is to build a "Gelephu Mindfulness City" (GMC)

As a carbon-neutral city, Gelephu would include only non-polluting industries (mainly IT, education, hotel and hospital sectors), and would be promoted as an investment destination and health and wellness hub in the middle of the region.

It would also lie at the crossroads of India's "Act East" plans for connectivity to Myanmar, and on to Association of Southeast Asian Nations and the Indo-Pacific region as well as the new India-Japan connectivity plans between India's north-eastern States through Bangladesh to the Bay of Bengal and Indian Ocean

- . At the 7th Indian Ocean Conference 2024 in Perth in February, External A□airs Minister highlighted the "need for lateral land-based connectivity across the Indian Ocean region,... essential to supplement and complement the maritime □ows" through "initiatives like the IMEC [India-Middle