MISSION X

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Innovation in Learning

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BIOTECHNOLOGY

Dermatophyte Infections & the Genetics of Susceptibility

NEWS IN BRIEF

- New genome-wide research has identified genetic markers that make some people more prone to chronic dermatophyte (ringworm) infections.
- Dermatophytes are keratin-digesting fungi behind common skin, hair and nail infections seen across India, especially in humid months.
- Findings point to variations in skin-barrier and immune-response genes as key to why infections recur or resist standard antifungals.
- The study strengthens India's push for genomic and One Health approaches to tackle rising antifungal drug resistance.

KEY CONCEPTS EXPLAINED

Dermatophyte: A fungus that infects keratinised tissue (skin, hair, nails) using the enzyme keratinase; causes ringworm/tinea.

Antifungal resistance: Reduced drug effectiveness against fungi, a growing public health concern parallel to antibiotic resistance.

One Health: An approach linking human, animal and environmental health, relevant since dermatophytes spread between humans, pets and soil.

⚡ UNIQUE FACT

Dermatophytes cannot survive below the skin because they require keratin as their only nutrient source, which is why infections stay confined to the outer skin, hair and nails and rarely become invasive in healthy individuals.

⚠ EXAM TRAP

Do not confuse dermatophytes with yeasts (like Candida). Dermatophytes are keratinophilic moulds causing ringworm/tinea, while Candida is a yeast causing infections like oral thrush and vaginal candidiasis; UPSC often tests this fungal classification distinction.

📌 PRELIMS MEMORY BANK

- Causative agents: Trichophyton, Microsporum, Epidermophyton genera
- Feed on: Keratin (via keratinase enzyme)
- Common disease: Tinea / ringworm
- Transmission: Human-to-human, animal-to-human, soil contact
- Relevant policy link: AMR (antimicrobial resistance) National Action Plan

PRELIMS PRACTICE MCQ

With reference to dermatophytes, consider the following statements:

1. They are yeast-like fungi that infect only the bloodstream.
2. They digest keratin found in skin, hair and nails.
3. Trichophyton and Microsporum are examples of dermatophyte genera.

Which of the statements given above is/are correct?

A. 1 and 2 only

B. 2 and 3 only

C. 1 and 3 only

D. 1, 2 and 3

✓ ANSWER: B

SOLUTION EXPLAINED

① THROUGH LOGICAL ANALYSIS

Statement 1 can be eliminated on logic alone: fungi described as strictly keratin-feeding organisms causing skin/hair/nail infections cannot simultaneously be described as bloodstream-only pathogens, since keratinised tissue is on the body's surface, not in circulation.

② THROUGH FACTUAL KNOWLEDGE

Dermatophytes are mould-like (not yeast-like) fungi belonging to genera such as Trichophyton, Microsporum and Epidermophyton. They use the enzyme keratinase to digest keratin in skin, hair and nails, causing superficial infections like ringworm (tinea), confirming statements 2 and 3.

ICT & ELECTRONICS

OLED Display Technology: Trends and Strategic Relevance

NEWS IN BRIEF

- OLED (Organic Light Emitting Diode) displays continue expanding across smartphones, TVs and now tablets in 2026, led by manufacturers in South Korea, China and Taiwan.
- India has been pushing display fabrication under the Semiconductor Mission, with OLED-linked component manufacturing gaining policy attention.
- OLED's self-emissive pixels eliminate the need for a backlight, enabling thinner devices, true blacks and higher contrast than LCDs.
- Chinese panel makers have significantly increased global OLED market share, intensifying the India-China-Korea-Taiwan competition in display technology.

KEY CONCEPTS EXPLAINED

OLED: Organic Light Emitting Diode; a display technology where each pixel emits its own light using organic compounds, without a backlight.

Self-emissive display: A display type where pixels generate their own light, unlike LCDs that need an external backlight source.

India Semiconductor Mission: A government programme to build domestic semiconductor and display fabrication capacity, reducing import dependence.

⚡ UNIQUE FACT

Unlike LCDs, OLED panels can achieve true black by switching individual pixels completely off, which is why OLED screens deliver far higher contrast ratios and are increasingly preferred for premium smartphones, TVs and foldable devices.

⚠ EXAM TRAP

Do not confuse OLED with LCD or LED-backlit LCD. LCD/LED-backlit displays require a separate backlight layer, while OLED pixels are self-emissive and need no backlight; this distinction is a common Prelims trap in technology-based questions.

📌 PRELIMS MEMORY BANK

- Full form: Organic Light Emitting Diode
- Key feature: Self-emissive pixels, no backlight needed
- Major producers: South Korea, China, Taiwan
- India link: Semiconductor Mission, display fab push
- Advantage: True blacks, higher contrast, thinner devices

PRELIMS PRACTICE MCQ

With reference to OLED display technology, consider the following statements:

1. OLED pixels require a separate backlight to produce images.
2. OLED technology allows individual pixels to be switched off completely.
3. India's Semiconductor Mission includes efforts to boost domestic display fabrication.

Which of the statements given above is/are correct?

A. 1 and 2 only

B. 2 and 3 only

C. 1 and 3 only

D. 1, 2 and 3

✓ ANSWER: B

SOLUTION EXPLAINED

① THROUGH LOGICAL ANALYSIS

Statement 1 fails on logic alone: the defining feature of OLED, repeatedly described as 'self-emissive,' inherently means pixels generate their own light, which is logically incompatible with requiring an external backlight layer.

② THROUGH FACTUAL KNOWLEDGE

OLED pixels are self-emissive and can be switched off individually to produce true blacks, unlike LCDs which need backlighting. India's Semiconductor Mission has also extended focus to display fabrication, confirming statements 2 and 3.

HEALTH

Marfan Syndrome Identified in Domestic Cats for the First Time

NEWS IN BRIEF

- Cornell University researchers published the first molecular characterisation of Marfan syndrome in domestic cats in Scientific Reports, September 2026.
- Two sibling cats, showing skeletal and cardiovascular abnormalities, were found to carry a mutated FBN1 gene, the same gene linked to human Marfan syndrome.
- Unlike humans, who need only one altered copy of FBN1 to show symptoms, the affected cats carried two altered copies (homozygous) of the gene.
- The discovery gives veterinary and human geneticists a new animal model to study connective tissue disorders and FBN1 gene function.

KEY CONCEPTS EXPLAINED

Marfan syndrome: A genetic disorder of connective tissue caused by mutations in the FBN1 gene, affecting the skeleton, eyes and cardiovascular system.

FBN1 gene: A gene that codes for fibrillin-1, a protein essential for the elasticity and strength of connective tissue.

Homozygous mutation: A condition where both copies of a gene (from each parent) carry the same mutation, unlike a heterozygous single-copy mutation.

⚡ UNIQUE FACT

While humans typically develop Marfan syndrome with just one mutated copy of the FBN1 gene (dominant inheritance), the affected cats needed two mutated copies to show the disorder, revealing a species-level difference in how the same gene mutation behaves.

⚠ EXAM TRAP

Do not assume Marfan syndrome in cats and humans follows identical inheritance patterns. In humans it is typically autosomal dominant (one copy sufficient), but in the studied cats the condition appeared only with a homozygous (two-copy) mutation, a key distinction UPSC could test as a statement-based trap.

📌 PRELIMS MEMORY BANK

- Gene involved: FBN1 (fibrillin-1)
- Discovered by: Cornell University (Scientific Reports, Sept 2026)
- Affects: Skeleton, eyes, cardiovascular system
- Cat case: Homozygous mutation (two altered copies)
- Human case: Typically autosomal dominant (one copy)

PRELIMS PRACTICE MCQ

Consider the following statements regarding the recent discovery of Marfan syndrome in domestic cats:

1. The disorder was linked to mutations in the FBN1 gene, the same gene implicated in human Marfan syndrome.
2. The affected cats required only a single mutated copy of the gene to develop the disorder.
3. Marfan syndrome primarily affects connective tissue, including the skeleton and cardiovascular system.

Which of the statements given above is/are correct?

A. 1 and 2 only

B. 1 and 3 only

C. 2 and 3 only

D. 1, 2 and 3

✓ ANSWER: B

SOLUTION EXPLAINED

① THROUGH LOGICAL ANALYSIS

Statement 2 can be eliminated logically: the discovery was described as scientifically notable precisely because the cats' condition differed from the typical human pattern, so a claim that it required only one copy (mirroring the human pattern) contradicts what made the finding significant.

② THROUGH FACTUAL KNOWLEDGE

The Cornell study confirmed the cats carried a homozygous (two-copy) FBN1 mutation, unlike the typical single-copy human pattern, while confirming FBN1 as the causative gene affecting connective tissue including skeleton and cardiovascular system, validating statements 1 and 3.

SPACE & ASTROPHYSICS

Milky Way's First Microblazar: IRAS 18293-0941

NEWS IN BRIEF

- Astronomers announced the discovery of the Milky Way's first confirmed 'microblazar,' named IRAS 18293-0941, around 22-25 September 2026.
- The research, led by teams including ASTRON, JIVE and the University of Amsterdam, has been accepted for publication in Astronomy & Astrophysics.
- The object is a stellar-mass black hole of about 10 solar masses, pulling material from a companion star in an 11-day orbit.
- It launches a jet moving at nearly the speed of light (about 0.75c), pointed almost directly at Earth, roughly 12,000 light-years away.

KEY CONCEPTS EXPLAINED

Blazar: An active galactic nucleus with a relativistic jet pointed almost directly at Earth, typically powered by a supermassive black hole.

Microblazar: A smaller-scale analog of a blazar, powered by a stellar-mass black hole rather than a supermassive one, within our own galaxy.

Relativistic jet: A high-speed stream of charged particles ejected from near a black hole, travelling close to the speed of light.

⚡ UNIQUE FACT

IRAS 18293-0941 is significant because it is the first blazar-like object ever confirmed inside the Milky Way, giving astronomers a nearby laboratory to study jet physics that would otherwise require observing galaxies millions of light-years away.

⚠ EXAM TRAP

Do not confuse a microblazar with a quasar or a standard blazar. A blazar/quasar is powered by a supermassive black hole at a galaxy's centre, millions of light-years away, while this microblazar is powered by a much smaller stellar-mass black hole located within our own galaxy, only about 12,000 light-years away.

📌 PRELIMS MEMORY BANK

- Object name: IRAS 18293-0941
- Black hole mass: ~10 solar masses (stellar-mass)
- Companion star orbit: 11 days
- Jet speed: ~0.75c (75% speed of light)
- Distance: ~12,000 light-years, within the Milky Way

PRELIMS PRACTICE MCQ

With reference to the recently discovered 'microblazar' IRAS 18293-0941, consider the following statements:

1. It is powered by a supermassive black hole at the centre of a distant galaxy.
2. It is the first confirmed blazar-like object located within the Milky Way.
3. Its relativistic jet travels at a speed close to, but less than, the speed of light.

Which of the statements given above is/are correct?

A. 1 and 2 only

B. 2 and 3 only

C. 1 and 3 only

D. 1, 2 and 3

✓ ANSWER: B

SOLUTION EXPLAINED

① THROUGH LOGICAL ANALYSIS

Statement 1 can be eliminated on logic alone: the object is repeatedly described as being within our own galaxy at a stellar-mass scale, which is logically inconsistent with being powered by a supermassive black hole located in a separate, distant galaxy.

② THROUGH FACTUAL KNOWLEDGE

IRAS 18293-0941 is powered by a stellar-mass (~10 solar mass) black hole within the Milky Way, not a supermassive one, making it the first confirmed microblazar in our galaxy. Its jet moves at about 0.75c, close to but below light speed, confirming statements 2 and 3.

DEFENCE TECHNOLOGY

SAT-SAAW: Satellite-Guided Smart Anti-Airfield Weapon

NEWS IN BRIEF

- The Ministry of Defence signed a Rs 810.79 crore contract with Bharat Dynamics Limited on 23 September 2026 for 160 SAT-SAAW units.
- SAT-SAAW is a DRDO-developed, satellite-guided precision glide bomb designed to strike enemy airfield infrastructure.
- It can be launched from Jaguar, Hawk-Mk132 and Su-30MKI aircraft, engaging targets from stand-off range beyond air defence reach.
- The deal falls under the Buy (Indian-IDDM) category, with around 60 percent indigenous content, boosting Atmanirbhar Bharat in defence.

KEY CONCEPTS EXPLAINED

Anti-airfield weapon: A precision munition designed to crater runways, taxiways and hangars, disabling an air base's operational capability.

Stand-off weapon: A weapon launched from a safe distance outside the range of enemy air defences, improving aircraft survivability.

Buy (Indian-IDDM): A defence procurement category for indigenously designed, developed and manufactured equipment with high local content.

⚡ UNIQUE FACT

SAT-SAAW uses satellite navigation combined with inertial guidance to achieve high strike precision on hardened airfield targets, making it one of the few indigenously developed glide bombs designed specifically for suppression of enemy air bases.

⚠ EXAM TRAP

Do not confuse SAT-SAAW with the SAAW already inducted earlier. SAT-SAAW is the satellite-guided, extended-range variant; the base SAAW (Smart Anti-Airfield Weapon) was inducted without the satellite-guidance upgrade. Also do not confuse it with BrahMos, which is a supersonic cruise missile, not a glide bomb.

📌 PRELIMS MEMORY BANK

- Developer: DRDO
- Manufacturer: Bharat Dynamics Limited (BDL)
- Contract value: Rs 810.79 crore (160 units)
- Launch platforms: Jaguar, Hawk-Mk132, Su-30MKI
- Category: Buy (Indian-IDDM), ~60% indigenous content

PRELIMS PRACTICE MCQ

Consider the following statements regarding the SAT-SAAW system:

1. It is a satellite-guided precision glide bomb developed by DRDO.
2. It is primarily designed to target enemy airfield infrastructure.
3. It can only be launched from naval warships.

Which of the statements given above is/are correct?

A. 1 only

B. 1 and 2 only

C. 2 and 3 only

D. 1, 2 and 3

✓ ANSWER: B

SOLUTION EXPLAINED

① THROUGH LOGICAL ANALYSIS

Statement 3 can be eliminated through logic: a weapon whose very name is 'Anti-Airfield Weapon' is conceptually built to strike land-based air base infrastructure, not to be launched from warships, making a naval-only launch claim internally inconsistent.

② THROUGH FACTUAL KNOWLEDGE

SAT-SAAW is a DRDO-developed satellite-guided glide bomb launched from fighter and trainer aircraft (Jaguar, Hawk-Mk132, Su-30MKI) to strike airfield infrastructure such as runways and hangars, confirming statements 1 and 2 as correct.

DEFENCE - NAVAL EXERCISE

Exercise Varuna 2026: India-France Naval Cooperation

NEWS IN BRIEF

- The 24th edition of Exercise Varuna began on 22 September 2026, with INS Trishul arriving at Toulon, France, for the bilateral drill.
- Exercise Varuna, initiated in 1983 and formally named in 2001, is one of India's oldest continuing bilateral naval exercises.
- The exercise covers both harbour and sea phases, including air defence, anti-submarine warfare and surface combat drills.
- It reflects deepening India-France strategic ties, especially in the Indo-Pacific maritime domain.

KEY CONCEPTS EXPLAINED

Bilateral naval exercise: A joint military exercise conducted between the navies of two countries to enhance interoperability and strategic ties.

Anti-submarine warfare (ASW): Naval operations aimed at detecting, tracking and neutralising enemy submarines.

Indo-Pacific strategy: A geopolitical framework emphasising cooperation across the Indian and Pacific Oceans, central to India-France defence ties.

⚡ UNIQUE FACT

Exercise Varuna began in 1983 without a formal name and was officially christened 'Varuna' only in 2001, after the Hindu god of the seas, making it one of the few Indian bilateral exercises to be renamed years after it originally began.

⚠ EXAM TRAP

Do not confuse Exercise Varuna (India-France naval exercise) with Exercise Garuda (India-France air force exercise) or Exercise Shakti (India-France army exercise). All three are India-France bilateral drills but cover different service branches, a frequent Prelims confusion point.

📌 PRELIMS MEMORY BANK

- Started: 1983; formally named 'Varuna' in 2001
- Countries: India and France
- 2026 edition: 24th, at Toulon, France
- Indian ship: INS Trishul (Talwar-class frigate)
- Sister exercises: Garuda (Air Force), Shakti (Army)

PRELIMS PRACTICE MCQ

With reference to Exercise Varuna, consider the following statements:

1. It is a bilateral naval exercise between India and France.
2. It was formally named 'Varuna' in the year it began, 1983.
3. The 2026 edition included harbour and sea phase drills.

Which of the statements given above is/are correct?

A. 1 and 2 only

B. 1 and 3 only

C. 2 and 3 only

D. 1, 2 and 3

✓ ANSWER: B

SOLUTION EXPLAINED

① THROUGH LOGICAL ANALYSIS

Statement 2 can be eliminated through careful reading: the passage distinguishes between when the exercise 'began' (1983) and when it was 'formally named' (2001), so collapsing both into the same year misreads the sequence of events described.

② THROUGH FACTUAL KNOWLEDGE

Exercise Varuna is confirmed as an India-France bilateral naval exercise that began in 1983 and was formally named 'Varuna' in 2001, not 1983. The 2026 edition (24th) included both harbour and sea phases, confirming statements 1 and 3.

DEFENCE - AIR DIPLOMACY

Mission Pegase 26: French Air Force Indo-Pacific Deployment

NEWS IN BRIEF

- Mission Pegase 26, France's 7th long-range air power projection mission, runs from 8 September to 15 October 2026.
- The deployment involves around 300 personnel, 4 Rafale fighters, 3 A330 MRTT Phenix tankers and 2 A400M Atlas transport aircraft.
- The mission covers a route of over 40,000 km spanning the Arctic, Indo-Pacific and Middle East regions.
- India serves as a stopover on the Indo-Pacific leg, with the French contingent also participating in India's Exercise Tarang Shakti.

KEY CONCEPTS EXPLAINED

Air power projection: The capability of an air force to deploy and sustain combat aircraft over long distances far from home bases.

MRTT (Multi Role Tanker Transport): An aircraft capable of both mid-air refuelling and troop/cargo transport, essential for long-range deployments.

Exercise Tarang Shakti: India's multinational air exercise bringing together air forces of friendly countries for joint combat training.

⚡ UNIQUE FACT

Mission Pegase 26 is remotely supported by the CAPCODA command and control centre based in France, allowing the French Air Force to coordinate a 40,000 km, multi-continent deployment without establishing a forward operating headquarters abroad.

⚠ EXAM TRAP

Do not confuse Mission Pegase with Exercise Tarang Shakti. Pegase is France's own long-range deployment mission (of which India is one stopover), while Tarang Shakti is India's multinational air exercise in which the French Pegase contingent participates; the two are distinct but linked events.

📌 PRELIMS MEMORY BANK

- Country: France (French Air and Space Force)
- Duration: 8 Sept - 15 Oct 2026 (7th Pegase mission)
- Assets: 4 Rafale, 3 A330 MRTT Phenix, 2 A400M Atlas
- Route: ~40,000 km, Arctic to Indo-Pacific to Middle East
- India link: Stopover + participation in Exercise Tarang Shakti

PRELIMS PRACTICE MCQ

Consider the following statements regarding Mission Pegase 26:

1. It is a long-range air power projection mission conducted by the French Air Force.
2. India served only as a refuelling stop with no participation in any joint exercise.
3. The mission's route spans the Arctic, Indo-Pacific and Middle East regions.

Which of the statements given above is/are correct?

A. 1 and 2 only

B. 1 and 3 only

C. 2 and 3 only

D. 1, 2 and 3

✓ ANSWER: B

SOLUTION EXPLAINED

① THROUGH LOGICAL ANALYSIS

Statement 2 can be eliminated logically: a mission explicitly described as including India's participation in Exercise Tarang Shakti cannot simultaneously be characterised as involving 'no participation' in any joint exercise, since the two descriptions directly contradict each other.

② THROUGH FACTUAL KNOWLEDGE

Mission Pegase 26 is confirmed as a French Air Force long-range projection mission spanning the Arctic, Indo-Pacific and Middle East, with India hosting a stopover where the French contingent also joined Exercise Tarang Shakti, confirming statements 1 and 3.