

### Study shows why chronic pain, depression go hand in hand

**Prelims:** General Studies Paper - 1  
Current events of national and international importance

**Mains:** General Studies - 3  
Science and Technology- developments and their applications and effects in everyday life.

#### 1. Context

- Chronic pain has major psychological effects, with nearly **85% of patients also experiencing depression**, along with anxiety and cognitive decline.
- A study in Science identifies **biological changes in the hippocampus (memory centre)** as the key link between pain and depression.
- The research combines **human brain data and animal experiments** to explain this progression.

Chronic pain is defined as pain that persists or recurs for **more than 3 months**, often continuing beyond the normal healing time of an injury or illness. (pain in the lower back, joints, stomach or headaches and migraines)

#### 2. Human Study: Key Findings

- Data from the UK Biobank (14,462 participants with brain scans) was analysed.
- Participants were grouped into:
  - Chronic pain without depression
  - Chronic pain with new depression
  - Chronic pain with persistent depression
- Led by Trevor Robbins (professor of cognitive neuroscience at the University of Cambridge) and Xiao Xiao (Fudan University associate professor), findings showed:

- ➔ **Enlarged hippocampus** in early-stage depression
- ➔ **Shrunken hippocampus** in long-term depression
- These changes were **independent of pain type**.
- Cognitive tests showed **better memory with larger hippocampus** and **decline with shrinkage**.

#### 3. Animal Experiments

- Chronic pain was induced in rodents (rats and mice) by **pinching the sciatic nerve that extends from the spine to the legs**, causing pain behaviours and later **anxiety/depression-like symptoms**.
- To understand the cellular changes mediating the progression from pain to depression, the researchers focused on **dentate gyrus (hippocampus region)** showed:
  - ➔ **Early stage:** increased **neuronal plasticity** and **better pattern recognition**
  - ➔ **Later stage:** reduced plasticity and impaired cognition (later stages of chronic pain, the ability to separate patterns was diminished).

**Neuronal plasticity** is the brain's ability to **change and adapt by forming new connections between brain cells**.

- Lesions in this region **reduced depression and anxiety despite ongoing pain**.

#### 4. Cellular Mechanism & Implications

- The study looks at two things in the brain:**
  - ➔ Inhibiting **new neurons** → reduced pain + emotional distress
  - ➔ Inhibiting **microglia** → reduced depression/anxiety but pain remained

**Microglia** are special immune cells in the brain that protect it by cleaning up damage and fighting infections.

- Microglia are **protective initially but harmful when chronically activated**.
- Chronic pain is not just physical but **gradually changes the brain over time in stages, requiring different types of treatment at each stage**.
- Chronic pain should be treated as **both a body problem + a brain/mental health problem**, not just physical pain.

### What rules govern international waters?

**Prelims:** General Studies Paper - 1  
Current events of national and international importance

**Mains:** General Studies - 2  
Effect of policies and politics of developed and developing countries on India's interests, Indian diaspora.

#### 1. Background of the Conflict

- Conflict escalated in the **Strait of Hormuz** after **Iran attacked and detained ships**.
- This was allegedly in response to **U.S. seizure of Iranian-linked ships** in international waters.
- Ship movement dropped sharply from **100 vessels/day to very few**.
- Iran introduced a **controlled transit system** based on **geopolitical considerations and a toll fee**.
- **India benefited**, as several Indian-linked ships were allowed passage.
- The Indian government has said it **has not paid any toll** and was only exercising **free navigation rights** given to merchant ships as per international law and practice.

#### 2. Actions by the United States

- Iran demanded **control over ship movement in the Strait of Hormuz** and the right to **charge transit fees**, aiming to **rebuild its economy**.
- After failed talks (April 12), the U.S. imposed a **blockade on Iranian ships**.
- The blockade involved **radio warnings and interception**, not full naval closure.
- U.S. **seized key vessels**:
  - ➔ **Touska** (container ship)
  - ➔ **Tifani** (oil tanker carrying 2 million barrels)

- Objective: **cut Iran's economic resources**, especially oil trade.

#### 3. Iran's Response

- Iran **fired at and turned back ships**, including **Indian-flagged vessels**.
- Captured **two container ships (Francesca, Epaminondas)**.
- Justified actions citing **maritime security violations**.
- Declared that the strait **cannot reopen unless the U.S. blockade ends**.
- Demonstrated **retaliatory escalation strategy**.

#### 4. Legal Issues & Future Outlook

- Governed by **UNCLOS (United Nations Convention on the Law of the Sea)**.
- Key principle: **freedom of navigation** in international waters.
- In straits like Hormuz, **the concept of "transit" is applied**:
  - ➔ Under **UNCLOS**, ships have the right to **free and uninterrupted transit passage**.
  - ➔ **Iran cannot block or control** merchant ship movement.
  - ➔ However, ships must:
    - ✘ Move **continuously without delay**
    - ✘ Follow **designated routes**
    - ✘ Use the strait **only for transit purposes**
    - ✘ **Not load or unload goods in violation of Iran or Oman's laws**
- **U.S. sanctions** are based on **domestic law**, not UN authorization.
- Possible resolution via **International Maritime Organization (IMO)**.
- IMO opposes **tolls and attacks on commercial shipping**.

## Will AAP MPs face disqualification after joining BJP?

**Prelims:** General Studies Paper - 1  
Indian Polity and Governance-Constitution, Political System, Panchayati Raj, Public Policy, Rights Issues, etc.

**Mains:** General Studies - 2  
Parliament and State legislatures—structure, functioning, conduct of business, powers & privileges and issues arising out of these.

### 1. Recent Political Development

- **7 out of 10 AAP Rajya Sabha MPs** joined the **BJP**.
- Led by **Raghav Chadha**, they claimed a **“merger” with BJP**.
- This amounts to **two-thirds strength**, which is crucial under law.

### 2. Anti-Defection Law (Tenth Schedule)

- Added by **52nd Constitutional Amendment Act, 1985**.
- Objective: Prevent **political defections (floor-crossing)**.
- A legislator can be **disqualified** if:
  - ➔ They **leave their party voluntarily**
  - ➔ If they **vote or abstain from voting against their party’s instructions (whip)**

### 3. ‘Split’ and ‘Merger’ Exceptions

#### Split Exception (removed in 2003):

- Earlier allowed if **1/3 members defected together**
- This exception was subsequently **removed by the 91st Constitutional Amendment in 2003**.

#### Merger Exception (still valid):

- No disqualification if:
  - ➔ **Original party merges with another party**
  - ➔ **AND 2/3 of legislators agree**

#### Key Issue (Ambiguity):

- **Conjunctive view:** A merger is valid only if **both the original party merges and 2/3 of legislators agree**.

- **Disjunctive view:** A merger is valid if **2/3 of legislators agree**, even **without a party-level merger**.

**Conjunctive** means **both conditions must be satisfied together**, whereas **disjunctive** means **either one condition is enough**.

### 4. Judicial Views & Expert Opinions

#### Supreme Court (2007 case):

- The **Supreme Court supported the conjunctive view** for the **now-deleted “split” exception**, requiring **both conditions to be met**.

#### Bombay High Court (2022 Goa case) - merger exception case:

- The **High Court followed the disjunctive view**, ruling that a **“deemed merger” occurs if 2/3 of legislators agree**, even **without approval from the original party**.

#### Experts’ Views:

- Some argue **party leadership consent is necessary** (true merger).
- Others say **2/3 MPs can trigger “deemed merger”**.

#### Key Concern:

- **Rajya Sabha MPs are elected by State MLAs, but here the MLAs remain in AAP while the MPs have joined BJP**.
- This creates a **disconnect between the electoral base and the MPs’ party**, weakening the **purpose of representation**.

## Can India move to 100% ethanol blending?

**Prelims:** General Studies Paper - 1  
Current events of national and international importance

**Mains:** General Studies - 2  
Infrastructure: Energy, Ports, Roads, Airports, Railways etc.

### 1. Context

- On April 21, Union Road Transport and Highways Minister Nitin Gadkari urged India to aim for **100% ethanol blending (E100)** to boost **energy self-reliance**.

- A government notification also **extended ethanol use for Sustainable Aviation Fuel (SAF)**.
- The move aligns with India's broader goals of **reducing crude oil imports and decarbonising transport**.

## 2. What is 100% Ethanol Blending & Vehicle Readiness

- **E100 refers to pure ethanol fuel**, but it is **less energy-dense than petrol**:
  - ➔ 1 litre of petrol gives **45-55% more energy** than 1 litre of ethanol.
- Most petrol engines are certified only up to **E20 (20% blending)**; older vehicles support even lower blends.
- Higher blends like **E85 or E100 require flex-fuel vehicles** that can run on varying ethanol levels.
- Flex-fuel vehicles need:
  - ➔ **Corrosion-resistant fuel systems**
  - ➔ **Special sensors and engine control units**
- In India:
  - ➔ Toyota has introduced a flex-fuel version of **Innova Hycross** costing **₹3-4 lakh more** than petrol variant
  - ➔ Maruti Suzuki and Hyundai are developing prototypes

## 3. Ethanol Production, Costs and Challenges

- India mainly produces ethanol from **sugarcane**, a **water-intensive crop**.
- Large-scale diversion of sugarcane to ethanol may **affect food prices and availability**.
- To address this, India promotes **second-generation ethanol** from **crop residues (e.g., rice straw)**, which may also **reduce stubble burning**.
- Challenges include:
  - ➔ **Higher production cost than petrol**, requiring government pricing support
  - ➔ **Indirect environmental costs**: land use, fertilisers, and water demand
- Though ethanol emits **less carbon monoxide and particulate matter**, lifecycle impacts remain significant.

## 4. Policy Framework, Energy Security & Aviation Use

- **Corporate Average Fuel Efficiency (CAFE)** is a regulation that sets limits on the **average fuel consumption or emissions of all vehicles produced by a manufacturer**.
- Phases:
  - ➔ **CAFE I (2017) → basic limits**
  - ➔ **CAFE II (2022) → stricter**
  - ➔ **CAFE III (2027) → ~30% stricter than before**
- So companies are pushed to make cleaner cars, including those that can run on ethanol (**E85/E100**).
- E20 fuel was introduced in 2023 and fully adopted by 2025, earlier than the target set under the National Biofuel Policy (2030), but it has **6-7% lower efficiency than petrol**, leading to higher running costs.
- **Ethanol in aviation (SAF)**:
  - ➔ Planes cannot easily use batteries or hydrogen, so they rely on **Sustainable Aviation Fuel (SAF)**, where ethanol is converted into jet fuel through the **Alcohol-to-Jet (ATJ)** process, producing a kerosene-like fuel that **does not damage engines** and can be blended up to **50% as approved by ASTM International**.
  - ➔ This highlights the need to **scale up ethanol production, diversify feedstock sources, and strengthen infrastructure** to ensure sustainable adoption.

## Species In News

### Nilgiri Tahr



- The **Nilgiri Tahr** (*Nilgiritragus hylocrius*) is an **endangered mountain ungulate** endemic to the **southern Western Ghats**.

- It is distributed over a **400 km stretch** across **Kerala and Tamil Nadu**, mainly inhabiting **grasslands with steep rocky cliffs**, which suit its ecological preferences.
- The **Eravikulam National Park** supports the **highest density and largest population** of Nilgiri tahr.
- It is closely related to the **Himalayan tahr** (*Hemitragus jemlahicus*) found in **Kashmir and Bhutan**, and the **Arabian tahr** (*Arabitragus jayakari*) found in **Oman and the UAE**.
- The **species is diurnal**, but are most active grazing in the early morning and late afternoon.
- **Nilgiri Tahr** is listed as **Endangered** on the **IUCN Red List**.

### Nanaimoteuthis jeletzkyi

- *Nanaimoteuthis jeletzkyi* was a **prehistoric finned octopus** from the **Late Cretaceous period** (100–72 million years ago) that acted as an **apex predator**, rivaling giant marine reptiles in the ancient food chain.
- It reached massive proportions, with estimates suggesting lengths of **7 to 19 meters**, potentially making it and its relatives the **largest invertebrates** ever documented.
- Fossilized jaws (beaks) show significant wear, proving these octopuses were **durophagous**, meaning they possessed the strength to **crush hard bones** and shells of their prey.
- The discovery of **asymmetric wear patterns** on their beaks suggests **high intelligence** and complex hunting behaviors, similar to the advanced cognitive traits seen in modern cephalopods.
- The research was made possible through **"digital fossil mining,"** using high-resolution tomography and **AI** to reconstruct fragile remains without removing them from their rock matrix.

## Places In News

### Eswatini



- **Eswatini** is a **landlocked country** located on the **eastern side of South Africa**, bordering **Mozambique**.
- It was earlier known as **Swaziland** and was officially renamed **Eswatini in 2018**.
- The term **"Swazi"** comes from **King Mswati II** (ruled **1840-1868**), an early ruler and nation builder.
- **Eswatini**, one of the **best-watered countries** in **southern Africa**, is crossed by major **perennial rivers** such as the **Lomati, Komati, Umbuluzi, and Usutu**.
- The country has had the **highest HIV prevalence rate in the world**, leading to **large-scale deaths and many orphans**.
- By **2022**, Eswatini made **significant progress in controlling the epidemic**, though the **impact of HIV remains substantial**.

### Falkland Islands

- The Falkland Islands (Islas Malvinas) are a **British Overseas Territory** located on the **Patagonian Shelf** in the South Atlantic Ocean, consisting of **two main islands-East and West Falkland-and hundreds of smaller outcrops**.

- A long-standing **sovereignty dispute** exists between the United Kingdom and Argentina, with the UK citing **self-determination of islanders**, while Argentina bases its claim on **colonial succession and geographical proximity**.
- The Falklands War (1982), triggered by an Argentine invasion, lasted **74 days** and ended in a **British victory**, leading to the **collapse of Argentina's military junta and restoration of democracy**.
- The islands have major economic importance due to **offshore oil and gas reserves** (e.g, **Sea Lion field**) and a strong fishing sector, especially exports of **Illex and Loligo squid**.
- Under international law, the United Nations classifies them as a **Non-Self-Governing Territory**, and **India supports a peaceful, negotiated bilateral resolution** of the dispute.

