

## Nuclear reactor

- Nuclear fuel is a highly regulated material because of its destructive potential.
- Countries maintain detailed inventories to safeguard it. Nuclear forensics uses analytical methods to identify the origins of nuclear materials and whether they were used for military applications.
- Spent fuel from boiling water reactors (BWRs) is hard to differentiate from that from pressurized water reactors (PWRs) because both “use water as moderator and have similar thermal neutron spectra, so they are quite similar in the neutron reaction mechanism
- Scientists in China have developed a technique to reliably identify whether some nuclear fuel originated in one of two common kinds of nuclear reactors, a difficult task in nuclear forensics, using experimental data and machine learning (ML)
- In BWRs, the fuel rods are submerged in water.
- When the fuel fissions, the water boils and the steam drives a turbine.
- In PWRs, the fuel rods aren’t exposed to the water; only the heat is exchanged

### About Nuclear reactor

- Nuclear reactors work by generating heat, which boils water to produce steam to drive the turbogenerators. In a nuclear reactor,
- Heat is the product of nuclear fission. Uranium and plutonium nuclei in the fuel are bombarded by neutrons and split usually into two smaller fragments, releasing energy in the form of heat, as well as more neutrons. Some of these released neutrons then cause further fissions, thereby setting.
- In BWRs (boiling water reactors) and PWRs (pressurized water reactors), collectively known as LWRs (light water reactors), the light water (H<sub>2</sub>O) coolant is also the moderator.
- PHWRs (pressurized heavy water reactors) use heavy water (deuterium oxide, D<sub>2</sub>O) as moderators.
- Unlike LWRs, they have separate coolant and moderator circuits. Coolant may be light or heavy water.
- The chain reaction is controlled by the use of control rods, which are inserted into the reactor core either to slow or stop the reaction by absorbing neutrons.

## Sodic soil

- As the world's soils continue to be impacted by salt, researchers have identified a protein that plays a crucial role in helping plants like sorghum grows in alkaline, salty soils (Science).
- The findings could inform the design of crops better suited to grow in underutilized sodic lands. Researchers performed a genome-wide association study of plant growth in alkaline conditions using sorghum and identified Alkaline Tolerance 1 (AT1) as a major locus especially related to the plant's sensitivity to alkaline, sodic soils.

## Sodic soil

- Sodicity in the soil is the presence of a high proportion of sodium ions relative to other cations.
- As sodium salts are leached through the soil, some sodium remains bound to clay particles displacing other cations.
- Soils are often considered sodic when the amount of sodium impacts soil structure.
- Sodicity degrades soil properties by weakening the bond between soil particles.

- Soil Sodicity can lead to a reduced flow of water through the soil which limits leaching and can cause salt to accumulate over time and the development of saline subsoils
- Dispersion in the soil surface, causing crusting and sealing, which then impedes water infiltration

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## Oxytocin

- Oxytocin plays an essential role in the spread of fear in zebrafish (Science), the results of which suggest a deeply conserved role for the hormone in emotional contagion the basal form of empathy among vertebrates like fish

## About Oxytocin

- Oxytocin is a natural hormone that manages key aspects of the female and male reproductive systems, including labor and delivery and lactation, as well as aspects of human behavior.
- Your hypothalamus makes oxytocin, but your posterior pituitary gland stores and releases it into your bloodstream.

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## Terminator zone

- A new study (The Astrophysical Journal) describes how extraterrestrial life has the potential to exist on distant exoplanets inside a special area called the ‘terminator zone’, which is a ring on planets that have one side that always faces its star and the other side that is always dark.
- Such planets are common because they exist around stars that make up about 70% of the stars seen in the night sky, so-called M-dwarf stars,
- A dwarf star is a star of relatively small size and low luminosity. Most main-sequence stars are dwarf stars.
- The terminator is the dividing line between the day and night sides of the planet. On the dark sides of terminator planets, the perpetual night would yield plummeting temperatures that could cause any water to be frozen into ice.
- The side of the planet always facing its star could be too hot for water to remain in the open for a long.

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## Bedaquiline and TB

- The Indian Patent Office rejected an application by pharmaceutical giant Johnson & Johnson (J&J) to extend

its patent on the drug bedaquiline beyond July 2023.

- Bedaquiline is a drug in tablet form used to treat drug-resistant tuberculosis (TB).

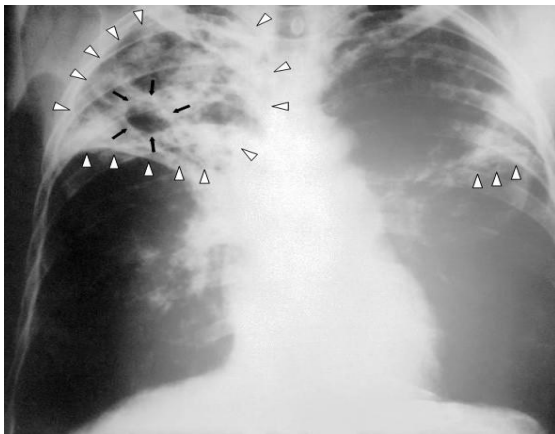


- This opens the door for drug manufacturers to produce generic versions of bedaquiline, which are expected to be more affordable and contribute to India’s goal of eliminating TB by 2025.

### What is drug-resistant TB?

- As of 2017, India accounted for around one-fourth of the world’s burden of multi-drug-resistant (MDR) TB and of extensively-drug-resistant (XDR) TB. MDR TB resists treatment by at least two frontline drugs in TB treatment, isoniazid, and rifampicin.

- XDR TB resists these two drugs as well as fluoroquinolones and any second-line injectable drug. XDR TB is rarer than MDR TB.
- Drug-resistant TB is harder to treat. One important option for those diagnosed with pulmonary MDR TB is bedaquiline.



- The Patent Office rejected the application on these and other grounds, including Sections 3d and 3e of the Patent Act.
- These pertain to the “mere discovery of a new form of a known substance which does not result in the enhancement of the known efficacy of that substance” and “a substance obtained by a mere admixture resulting only in the aggregation of the properties of the components thereof”, respectively, which are not Patentable

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### **INSACOG**

- The Indian SARS-CoV-2 Genomics Consortium (INSACOG), jointly

initiated by the Union Health Ministry of Health, and the Department of Biotechnology (DBT) with the Council for Scientific & Industrial Research (CSIR) and Indian Council of Medical Research (ICMR), is a consortium of 54 laboratories to monitor the genomic variations in the SARS-CoV-2.

- INSACOG is a multi-laboratory, multi-agency, Pan-India network to monitor genomic variations in the SARS-CoV-2 by a sentinel sequencing effort which is facilitated by the National Centre for Disease Control (NCDC), Delhi involving the Central Surveillance Unit (CSU) under Integrated Disease Surveillance Programme (IDSP).
- The data from the genome sequencing laboratories is being analyzed as per the field data trends to study the linkages (if any) between the genomic variants and epidemiological trends.
- This helps to understand super spreader events, and outbreaks and strengthen public health interventions across the country to help in breaking the chains of transmission.

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