Prelim Bits 17-12-2021 | UPSC Daily Current Affairs

Parker Solar Probe

For the first time, NASA's Parker Solar Probe has officially "touched" the sun, plunging through the unexplored solar atmosphere known as the corona.

- Parker Solar Probe was launched in 2018 to explore the mysteries of the Sun by travelling closer to it than any spacecraft before.
- Parker was 13 million kms from the center of the sun when it first crossed the jagged, uneven boundary between the solar atmosphere and outgoing solar wind.
- Now, the spacecraft found itself in a region where the magnetic fields were strong enough to dominate the movement of particles there.
- These conditions were the definitive proof the spacecraft had passed the Alfvén critical surface and entered the solar atmosphere where magnetic fields shape the movement of everything in the region.
- The corona appeared dustier than expected. Because the sun lacks a solid surface, the corona is where the action is.
- **Significance** - Future coronal excursions will help us better understand the origin of the solar wind, and how it is heated and accelerated out into space.
- Exploring this magnetically intense region up close can help us better understand solar outbursts that can interfere with life on Earth.
- It will provide us with deeper insights into our Sun's evolution and its impacts on our solar system, and everything we learn about our own star (the sun) also teaches us more about stars in the rest of the universe.
- So, the Parker will keep drawing ever closer to the sun and diving deeper into the corona until its grand finale orbit in 2025.

Reference

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Chaperones

- Chaperone proteins or Molecular chaperones are group of proteins that is present in all organisms and are essential for cell survival.
- One of the major functions of molecular chaperones is to facilitate protein folding i.e. amino acid folding.
- Although the amino acid sequence of a protein contains the information required to adopt the native conformation, not all proteins can fold spontaneously. Here, chaperones help.

Unfolded polypeptides are generated during normal growth as the product of protein synthesis.

But misfolded proteins arise as a consequence of cellular stresses, such as heat shock, oxidative stress, as well as pathological conditions.

- After the new protein chain has been shaped correctly, chaperones move on. Or else the new chain is eliminated.
- Without chaperones, newly synthesised proteins would soon become a tangled mess of insoluble aggregates, hindering cellular processes.
- Chaperones are needed under physiological conditions too, for normal cellular function.

- Major chaperones in humans include HSP70, HSC70 and HSP90: the numbers express the size of the proteins in kilodaltons.
- HSC70 is always present at high levels in normal cells, whereas HSP70 is induced by heat.
- **Heat shock proteins** - Many molecular chaperones belong to the class of “heat shock” proteins (or stress-response proteins).
- In normal cells, 1%–2% of all proteins present are heat shock proteins.
- This number rises threefold during stressful conditions.
- This is because whenever an organism is subjected to elevated temperatures, proteins in the system begin to lose their native shapes, and chaperones are produced in large quantities to restore order.
- **Molecular thermometer -** HSC70 appears to be more like a molecular thermometer, with an ability to sense cold temperatures.
- Disorders related to cold sensitivity (like Familial Cold Auto-inflammatory Syndrome) are caused by mutations in proteins that regulate inflammation.
- At normal body temperatures, HSC70 is able to coax these mutated proteins to fold correctly and thus function normally.
- In cold conditions, however, the HSC70 molecule is itself slightly altered in its shape and is not able to unerringly interact with the mutated regulators of inflammation.
- This leads to a pathological state with symptoms such as chills, joint pains and rich red skin rashes setting in within two hours.

Misfolding of proteins can cause a number of diseases

Disease	Abnormality with the Protein
Parkinson's disease	Misfolding of Alpha-synuclein protein (present in neurons)
Alzheimer's disease	Brains of patients have plaques formed from aggregates of amyloid beta-peptide. Accumulation of amyloid fibrils is toxic to neurons.
Autosomal Dominant Congenital Cataract	Aberrant folding of crystallins of the eye lens

- **Anti-cancer agents** - Cancer cells divide at break-neck pace, and heat shock proteins are important in maintaining the stressful cancerous state.
- An overabundance of heat shock proteins in cancer cells is an indicator of a poor prognosis.
- Cancerous cells accumulate mutations in proteins that would normally suppress tumours.
- HSP70 and HSP90 play the roles of villains, as they continue to fold the mutated proteins, thus allowing tumour progression.
- In the laboratory, inhibitors of HSP90 have shown much promise as anti-cancer agents.

- However, no inhibitor has yet been approved for human use, as the levels required for these to be effective are too toxic for your body.

Reference

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2. https://www.sciencedirect.com/topics/neuroscience/chaperone

Pyronema

A new study has found that the food source that allows Pyronema, a genus of pyrophilous fungi, to appear so quickly in big numbers after a fire is the damage left by the fire itself.

- Like trees, some fungi are adapted to fire. They are known as pyrophilous, or "fire-loving" fungi.
- After a fire, pyrophilous fungi show up from nowhere, basically, even in areas that haven't burned for decades. Some sprout in fiery shades of orange and pink. It's a worldwide phenomenon.
- Charcoal is difficult for many organisms to break down, said Thea Whitman, an associate professor of soil ecology at the University of Wisconsin-Madison and Fischer's co-author.
- The new study found that Pyronema can decompose (eat) charcoal.
- This was found by feeding the Pyronema with pine seedlings in an atmosphere with carbon dioxide containing carbon-13.
- [Carbon-13 is an isotope whose unusual weight makes it easy to trace.]
- Pyronema can eat charcoal, but it really doesn't like to. It may first enjoy that layer of dead organisms, and then switch to charcoal when it must.
- **Significance** - As Pyronema is breaking down charcoal after a fire, it is capable of an important player in post-fire recovery of the ecosystem.
- Implications are reduced soil erosion and enhanced moisture retention.

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White Rhinos

Thirty white rhinos were transferred from South Africa to Rwanda in a Boeing 747.

- White Rhinos are the second-largest land mammal.
- Also known as the square-lipped rhinoceros, white rhinos have a square upper lip with almost no hair.
- Two genetically different subspecies exists the northern and southern white rhino, and are found in two different regions in Africa.
- White rhino populations decreased by 12% between 2012 and 2017.
- **Southern white rhino** is considered as "Almost Endangered (IUCN)"
- According to the World Wildlife Fund (WWF), there are currently 20,000 southern white rhinos

in the world.
- The majority (98.8%) of the southern white rhinos occur in just four countries: South Africa, Namibia, Zimbabwe, and Kenya.
- **Northern white rhino** is on the brink of extinction, with only 2 females remaining.
- They live in the Ol Pejeta Conservancy in Kenya and are protected round-the-clock by armed guards.
- Their near extinction is due to decades of poaching for rhino horn.
- **Social structures** - White rhinos have complex social structures.
- Groups of sometimes 14 rhinos may form, notably females with calves.
- Adult males defend territories of roughly one square mile, which they mark with vigorously scraped dung piles.
- The home range for adult females can be more than seven times larger, depending on habitat quality and population density.
- Breeding females are prevented from leaving a dominant male's territory, which is marked and patrolled by its owner on a regular basis.
- Males competing for a female may engage in serious conflict, using their horns and massive size to inflict wounds.

Reference

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Kazhuveli Wetlands Bird Sanctuary

Ministry of Environment and Climate Change had declared the Kazhuveli wetlands as the 16th bird sanctuary in Tamil Nadu.

- Kazhuveli wetland is located near Villupuram in Tamil Nadu. It lies adjacent to the Bay of Bengal along the east coast.
- Kazhuveli wetlands is said to be the second largest brackish water lake in South India after Pulicat Lake.
- Kazhuveli brackish water lake wetlands are of adequate ecological, faunal, floral and geomorphological significance for the purpose of protecting, propagating and developing wildlife and its environment.
- It is a feeding ground for long-distance migrants from the cold subarctic regions of Central Asia and Siberia including Black-tailed Godwits, Eurasian Curlew, White Stork and Ruff.
- The Grey-tailed Tattler, a rare migratory wader, has been recorded only here and in Pulicat across the country.

Kazhuveli falls in the Central Asian migratory path of birds.

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