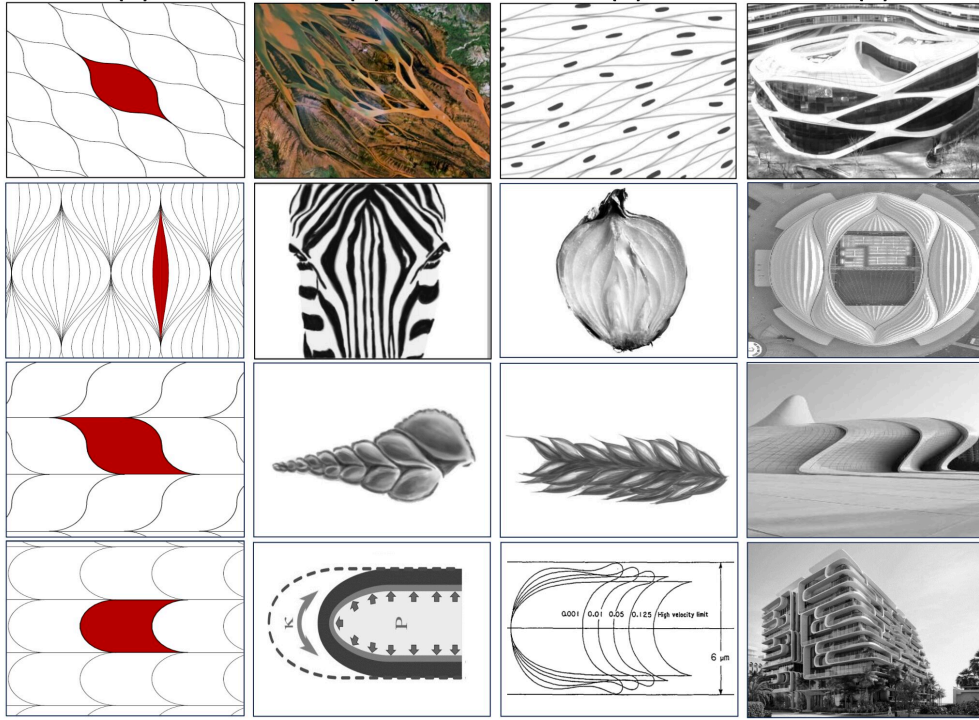


## UPSC Daily Current Affairs | Prelim Bits 30-09-2024

### Soft Tiling

Recently, scientists have found a new kind of cell that doesn't follow shape rules but involves in tiling.

- **Tiling** - In mathematics, it refer to the process where any geometric shape covers a surface such that they leave no gaps between them.
  - Example: Square tiles in house cover the floor completely.
- **Classical shapes** - The shapes most commonly used as tiles has **positive curvature** at its vertices having sharp corners and straight edges.
  - Example: Triangles, squares, hexagons, cubes, and other polyhedral shapes typically the tiles that fill 2- and 3-dimensional spaces with no gaps.
- **Soft cells** - It is a new class of shape that stands apart from classical geometric forms by having a **form of distributed curvature**.
  - **In 2D** - 2 pointed corners
  - **In 3-D** - No corners
  - **Edges** - Rounded edges
- Here, the curvature is spread smoothly along their edges instead of sharp deviations at specific points as in classical shapes.
- **Soft cell tiling** - Mathematically, this distribution minimises the number of high-curvature points i.e. corners while still allowing the shape to tile a space.
- Many natural structures like muscle cells, zebra stripes, and the layers of onion bulbs are covered in 2D tiles.
- These natural systems display a biological preference for curved, smooth-edged shapes.



- **Tiling in Nautilus shell** - The chambers inside these shells lack sharp corners in 3D.
  - When they're sliced open, they reveal a 2D soft-cell tiling.
- This relationship between 2D and 3D forms illustrates how soft cells could be involved in both biological tissue formation and processes like tip growth.

*The researchers found they could make 3D soft cells by softening the edges and eliminating sharp corners completely. Here, the cells acquire a smooth, curved form that seamlessly fills a 3D volume without the need for angled protrusions.*

- **Significance** - The mathematics of soft cells also suggests nature prefers to minimise sharp corners for structural reasons and functional efficiency.
- This paves the way for new insights into why certain biological and natural patterns emerge while others don't
- It opens new avenues of mathematical study and has significant implications for biology, architecture, and materials science.

## Reference

[The Hindu| Tiling by Soft Cells](#)

## Joint Hunting by Octopus and Fish

*A new study lifts the veil on what happens when octopuses and fish hunt together.*

## Cross Species Relationship

- It is the cooperation between individuals from different species.
- **In mammals** - There is a close relationship between *dogs and humans* in the context of herding sheep or hunting where both the dog and the human work together to achieve a goal.
- **In underwater species** - A nice example is the *joint hunting behaviour of moray eels and grouper*.
- The *grouper approaches the moray and signals* that it wishes to hunt and the eel responds in kind, and off they go.
- The *eel can scare the prey fish* from hiding places among the coral, while the grouper patrols over the top.

- **Hunting by Octopus and Fish** - There is a cross species interactions between the usually solitary day octopus (*Octopus cyanea*) and several fish species, such as goatfish and groupers.
- They share a common goal, to increase their hunting efficiency.
- **Traditional view** - In this scenario, the octopus would be solely in charge of decisions and the fish just follow (that is, it's an exploitative, despotic relationship).
  - **Octopus** - The producer, with its long, flexible arms, it explores all the nooks and crannies of the hunting ground, flushing out prey the fish can then take advantage of.
  - **Fish** - It simply follow along and opportunistically pick up the scraps.
- **Democratic relationship** - New findings reveal that each partner in the interaction plays a specific role and there is no true leader.
  - **Fish** - They were responsible for *exploring the environment* and deciding where to move.
  - **Octopus** - It would *decide if and when to move*.
- **Controlled experiments** - They showed the *octopuses were guided by social information* provided by the fishes.
  - **Octopus with blue goatfish** - Its foraging tactics where more focused and efficient.
  - **Octopus with blacktip groupers** - They were less focussed and efficient.
- **Significance of the study** - The nature of the hunting relationship varied depending on who's involved.
- The success rates for capturing prey were higher for the octopus when foraging with fishy partners.

## Reference

[The Hindu| Joint Hunting by Octopus and Fish Species](#)

## Supramolecular self-assembly

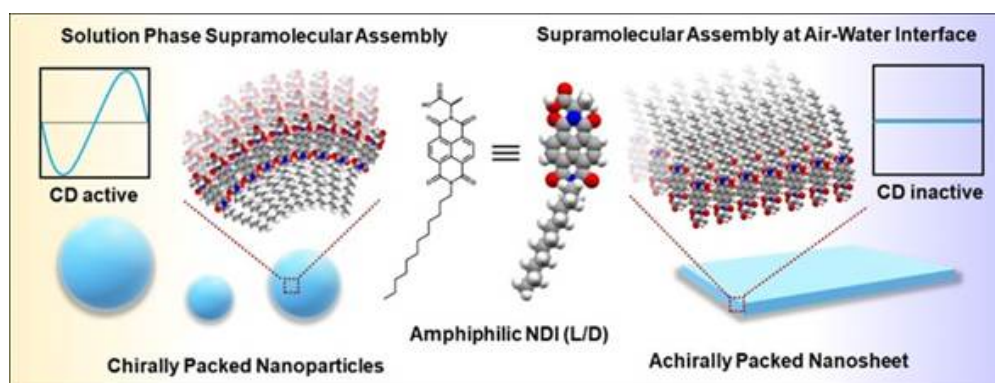
*A new breakthrough in understanding the process of controlling the assembly of tiny molecular units into complex structures.*

- **Supramolecular self-assembly** - It is a process where small molecules spontaneously organize into larger, well-defined structures without external direction.
- **Research findings by** - It is done by *2 autonomous institutes* in Bengaluru under Department of Science and Technology (DST)

- Centre for Nano and Soft Matter Sciences (CeNS)
- Jawaharlal Nehru Centre for Advanced Scientific Research
- **Key findings** - They explored the *self-assembly behaviour* of specific molecules called **chiral amphiphilic naphthalene diimide** derivatives (NDI-L and NDI-D).
- They experimented with 2 different methods of assembling.

	Solution Phase Assembly	Air-Water Interface Assembly
Assembly Environment	In a liquid solution	At the boundary between air and water
End product	Forms spherical nanoparticles.	Forms into a flat, two-dimensional layers with irregular edges
Properties	Unique optical properties, such as strong mirror-imaged circular dichroism (CD) signals, which are important for materials that interact with light in precise ways.	not exhibit the same optical properties as the solution-assembled nanoparticles

- It indicates that the environment in which molecules assemble plays a critical role in determining their final structure and properties.



- **Significance** - Understanding this process is crucial *for creating new organic materials* that can be used to develop nanodevices.
- It not only advance the *field of material science* but also provide a foundation *for future innovations* in various industries.
- For example,
  - **In biomedicine**, it could be used to develop *more effective drug delivery* systems that target specific areas of the body.
  - **In electronics**, these materials could lead to the development of *faster, more efficient devices*.

## Reference

[PIB| Research Findings of Supramolecular Self Assembly](#)

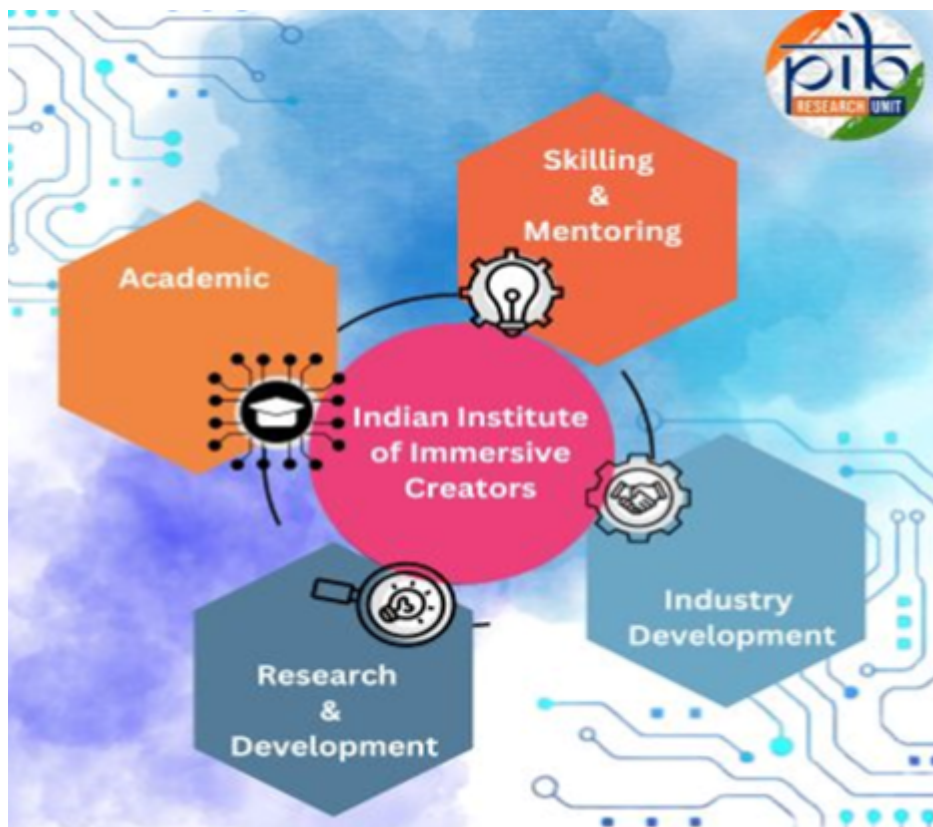
## National Centre of Excellence (NCoE) for AVGC

Union Cabinet Approves National Centre of Excellence for AVGC-XR in Mumbai.

### AVGC-XR

- **AVGC-XR** - Animation, Visual Effects, Gaming, Comics and Extended Reality.
- This sector that is set to be the future of the media and entertainment industry.
- **In India** - According to the *FICCI-EY 2024 report*, India now boasts the *2<sup>nd</sup> largest anime fan base globally* with a *growth rate of 25%* and an estimated value of Rs.46 billion by 2023.
- It is projected to *contribute 60% to the worldwide growth in anime* interest in the coming years.

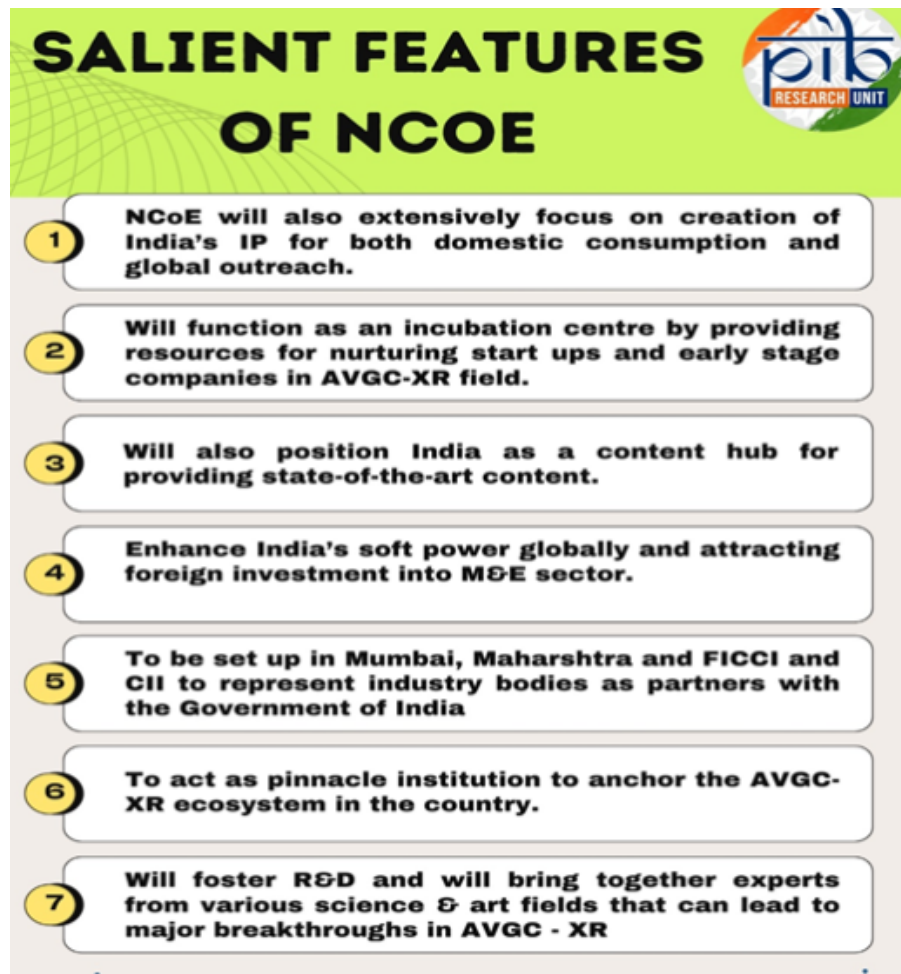
- **NCoE AVGC** - Provisionally named the ***Indian Institute for Immersive Creators (IIIC)***.
- It will be modelled after institutions like the Indian Institutes of Technology (IITs) and Indian Institutes of Management (IIMs).
- **Mission** - To revolutionize the AVGC sector and *foster innovation* in immersive technologies and to *create a world class talent pool* in India to cater to the Indian as well as global entertainment industry.



- **Key Objectives** - Focusing of creating Indian IP and leveraging our cultural heritage in new age
- Create a multiplier effect in the industry.
- An industry led initiative, in partnership with state and academia.
- Integrated focus on education, skilling industry, development, innovation.
- Hub and spoke model of development to be followed.
- IIIC as the hub and several center's as its spokes dedicated innovation and research



fund to promote start-up ecosystem.



*National Centre of Excellence (NCoE) will be set up as a Company under the Companies Act, 2013 in India with FICCI and CII representing the industry bodies as partners with the Government of India.*

## Reference

[PIB| National Centre of Excellence for AVGC](#)

## Star System T Coronae Borealis

*North Americans are in for a celestial treat as a star is set to explode in the coming days.*

- **T Coronae Borealis (T CrB)** - It is a two-star system, which is located 3,000 light-years away from Earth.
- This Star System is also known as 'Blaze Star', is not visible from Earth.
- **2 Star System** - It comprises a red giant star and a white dwarf star, both orbiting each other.
- The age difference between them being billions of years.
- **Visibility of explosion** - It will be so bright and enormous that humans would be able to see it for nearly a week without any special equipment.
- It would take around 57 million years to reach it even if one were flying through space

at 35,000mph.

- Despite being this far, people on Earth can see it with naked eye.

## 2 stages of a Star's Life

- **Red Giant** - A star becomes a red giant *during its final stages* and blows up in size.
- **White dwarfs** - They are *small* and come into existence after a star has exhausted its nuclear fuel and is slowly cooling down.
- **Transition of White Dwarf to Red Giant** - For a star to go from a white dwarf to a red giant takes billions of more years.
- The white dwarf will *undergo a thermonuclear explosion* as it has been absorbing the red giant's hydrogen for a long time.
- This has led to a build-up of material on its surface putting it under more pressure and heat.

## Reference

[WION News | Explosion of the Star System T Coronae Borealis](#)

