Bio Computers

Why in news?

Scientists outlined a plan for a revolutionary area of research called organoid intelligence, which aims to create bio computers which harness the processing power of the brain.

What is the need for this technology?

- Traditionally, researchers have used rat brains to investigate various human neurological disorders.
- There are several differences in structure and function in the cognitive capacities of rodents and humans.
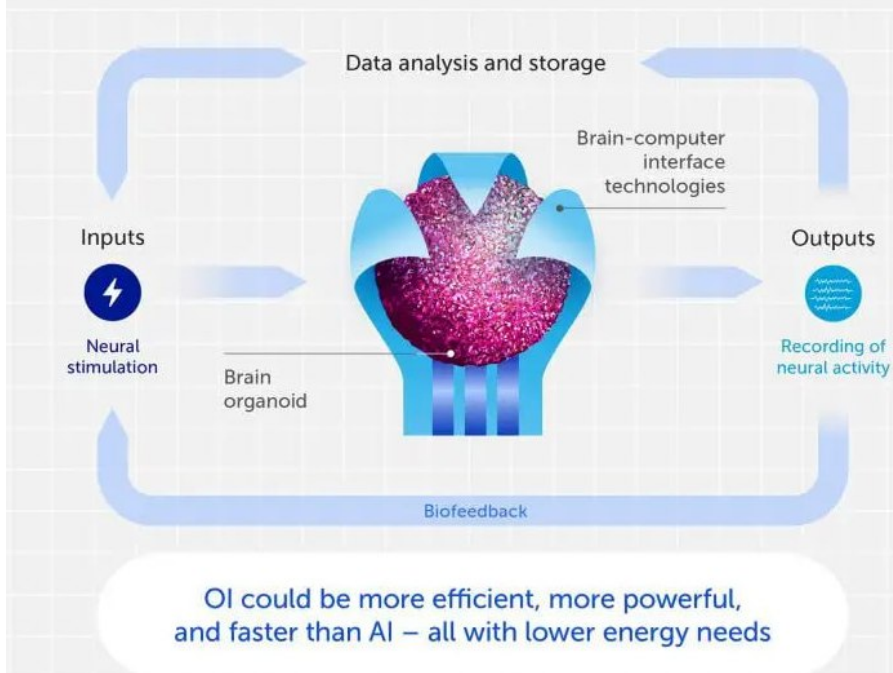
A new field called organoid intelligence could be the basis for computers powered by human brain cells.

What are bio computers?

- **Brain organoids –** They are 3D cultures of brain tissue developed in the lab.
- They are used to study human brain development and test drugs to see how they respond.

- **Bio computers –** The brain organoids will be combined with modern computing methods to create bio computers.
- **Machine learning –** The organoids will be coupled with machine learning by growing the organoids inside flexible structures affixed with multiple electrodes.
- These structures will be able to record the firing patterns of the neurons and also deliver electrical stimuli, to mimic sensory stimuli and later analysed by machine-learning techniques.

Organoid intelligence
The new frontier in biocomputing

Data analysis and storage

Brain-computer interface technologies

Inputs

Neural stimulation

Brain organoid

Outputs

Recording of neural activity

Biofeedback

OI could be more efficient, more powerful, and faster than AI — all with lower energy needs

What are the advantages of bio computers?

- **Process complex data –** While human brains are slower than computers in simple arithmetic, bio computers outshine machines at processing complex information.
- **Easily to develop –** Brain organoids can also be developed using stem cells from individuals with neurodegenerative diseases or cognitive disorders.
- **Biological basis –** Comparing the data on brain structure, and signalling between healthy and patient-derived organoids can reveal the biological basis of human cognition, learning, and memory.
- **Decode pathology –** They could also help decode the pathology of devastating neurodevelopmental and degenerative diseases such as _Parkinson's disease and microcephaly_.

The Tele-Mental Health Assistance and Nationally Actionable Plan through States (T-MANAS) initiative was announced by the NIMHANS under the NTMHP to provide free round-the-clock tele-mental health services in all parts of the country.

What are the limitations of bio computers?

- **Not sophisticated –** The human brain requires various sensory inputs to develop into the complex organ it is, and brain organoids developed in the lab aren't sophisticated enough.
- The organoids currently also _don't have blood circulation_, which limits how they can grow.

- **Smaller in size –** Currently, brain organoids have a diameter of less than 1 mm and have fewer than 100,000 cells, which make it roughly three-millionth the size of an actual human brain.
- So scaling up the brain organoid is key to improving its computing capacity, as will incorporating _non-neuronal cells_ involved in biological learning.
- **Microfluidic systems –** Researchers will have to develop microfluidic systems to transport oxygen and nutrients, and remove waste products.
- These hybrid systems will generate very large amounts of data, which researchers will need to store and analyse using _Big Data infrastructure_.
- **Ethical issues –** There is also a proposal to have an ethics team to parallelly identify, discuss, and analyse ethical issues as they arise in the course of this work.

Reference

1. [The Hindu │What are bio computers?](#)