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A Shankar IAS Academy Initiative

## 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.

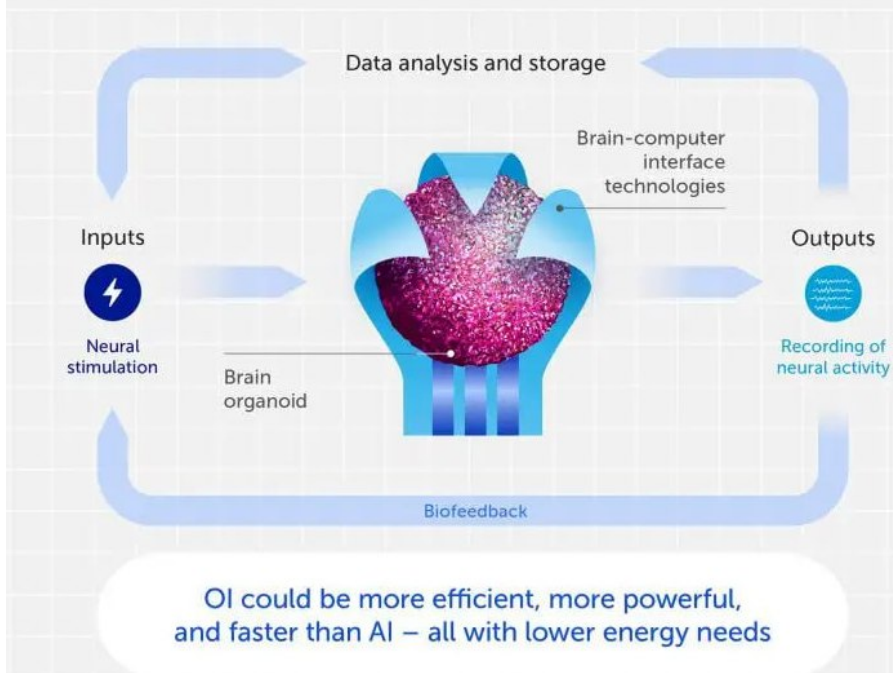
*A new field called organoid intelligence could be the basis for computers powered by human brain cells.*

### 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



### 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?](#)



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