Can organoids, derived from stem cells, be used in disease treatments?

What is an organoid?

Organoids are a group of cells grown in laboratories into three-dimensional, miniature structures that mimic the cell arrangement of a fully-grown organ.

They are tiny (typically the size of a pea) organ-like structures that do not achieve all the functional maturity of human organs but often resemble the early stages of a developing tissue.

Most organoids contain only a subset of all the cells seen in a real organ, but lack blood vessels to make them fully functional.

Achievements:

In some cases, scientists have already transplanted such lab-grown brain organoids to adult animals.

The transplanted organoid had integrated with the animal brain, grown new neuronal connections and responded to light.

Similarly, lung organoids transplanted into mice were able to form branching airways and early alveolar structures.

How organoids are grown in lab?

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Advantages of organoids:

Organoids offer new opportunities to studying proteins and genes that are critical for the development of an organ. This helps in knowing how a mutation in a specific gene causes a disease or disorder.

For example, researchers have used brain organoids to study how the Zika virus affects brain development in the embryo.

Since the organoids closely resemble mature tissues, it opens up new vistas. These include studying the complex arrangements of cells in three-dimension and their function in detail, and understanding how cells assemble into organs.

Organoids can be used to study the safety and efficacy of new drugs and also test the response of tissues to existing medicines.

Organoids will bring precision medicine closer to reality by developing patient-specific treatment strategies by studying which drugs the patient is most sensitive to.

Challenges:

Scientists argue that organoids do not have sensory inputs and sensory connections from the brain are limited. Isolated regions of the brain cannot communicate with other brain regions or generate motor signals. Thus, the possibility of consciousness or other higher-order perceptive properties [such as the ability to feel distress] emerging seems extremely remote.