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How Are Indian Institutions Advancing Organoid Research?

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For Indian businesses, the combination of robotics, artificial intelligence, and organoid technology offers enormous potential for creating automated, scalable organoid production systems.

The global organoids market is experiencing explosive growth, valued at $1.74 billion in 2025 and projected to reach $3.49 billion by 2034 at a 15.63 per cent CAGR. While India's organoids and spheroids market specifically generated $153.1 million in 2024 and is expected to reach $603.2 million by 2030, representing a robust 26.6 per cent CAGR.

India's organoid research ecosystem is rapidly developing, with key institutions leading groundbreaking studies across multiple therapeutic areas. The Indian Institute of Science (IISc) in Bengaluru has emerged as a prominent hub, with researchers like Ramray Bhat at the Molecular Reproduction, Development and Genetics (MRDG) department actively studying cancer organoids, particularly ovarian and breast cancer models using 3D cell culture systems. The Centre for Neuroscience at IISc has also leveraged existing expertise in engineering, mathematics, physics and biology to advance cerebral organoid research for modelling human brain development and microcephaly.

The Post Graduate Institute of Medical Education & Research (PGIMER) has made significant strides in developing patient-specific neurovascular organoids from autologous blood, targeting neurodegenerative diseases including autism, Attention Deficit Hyperactivity Disorder (ADHD), Alzheimer's and Parkinson's disease. This cost-efficient approach requires only autologous plasma and blood cells, eliminating the need for specific differential media or growth factors.

The Centre for Cellular and Molecular Biology (CSIR-CCMB) in Hyderabad is conducting a major research initiative on "Organoid models for biomedical research applications" from 2020, funded by the Council of Scientific and Industrial Research (CSIR), focusing on stem cell-based organoid development. Additionally, the Institute for Stem Cell Science and Regenerative Medicine (inStem) continues advancing human embryonic stem cell research and gastruloid development.

Key companies driving organoid-related research include Pandorum Technologies, a Bengaluru-based biotechnology company specialising in tissue engineering and regenerative medicine, which has developed proprietary platforms combining therapeutic exosomes with biomaterials for cornea, liver and lung tissue regeneration. The company has secured government grants (BIG, SBIRI) and private funding, positioning itself as India's first company to 3D-print human liver tissue for medical research in 2015.

Stellixir Biotech in Bengaluru provides specialised services in 3D spheroid culture and stem cell research, offering anti-cancer cell-based drug screening and predictive toxicology services. Meanwhile, companies like InSphero have established distribution partnerships with Indian suppliers like Bionova Supplies to accelerate spheroid and organoid culture development in India.

Recent international research, including work by Agarwal et al. on human epidermis organotypic cultures published in Experimental Dermatology, demonstrates reproducible systems for recapitulating human epidermis in vitro, offering valuable models for dermatological research and drug screening. Such methodologies present opportunities for Indian researchers to develop standardised organoid protocols for various tissue types.

While India's organoid research shows promise, significant gaps exist in clinical translation compared to global leaders. Internationally, organoids have successfully transitioned from bench to bedside through patient-derived organoid (PDO) clinical trials for personalised cancer treatment, with platforms predicting clinical efficacy and guiding therapeutic decisions. Companies like HUB Organoids globally have demonstrated the ability to reduce drug development timelines from 10-15 years to approximately 5 years through organoid-based screening.

Indian research remains predominantly in preclinical stages, with PGIMER's neurovascular organoid prototype being filed for patent protection but not yet in clinical trials. However, this represents an opportunity for India to leverage its strong pharmaceutical manufacturing base and clinical trial capabilities to accelerate organoid-based therapeutic development.

India faces several challenges, including limited regulatory frameworks for organoid-based therapies, insufficient standardisation protocols, and the need for enhanced public-private collaboration. However, the strong foundation in biotechnology research, growing investment climate, and government support through initiatives like the National Biotechnology Development Strategy position India well for future growth.

With proper investment in infrastructure and regulatory development, India can transition from a research-focused to a commercially viable organoid market, potentially becoming a global hub for affordable organoid-based therapeutics.

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