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Organoids and Stem Cells: Revolutionizing Disease Modeling and Personalized Medicine**Elena Rossi**

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Stem cell-derived organoids have transformed biomedical research by providing three-dimensional tissue models that closely resemble human organs in both structure and function. Unlike conventional cell culture systems, organoids better replicate the physiological microenvironment, making them valuable tools for studying human development, disease progression, and drug responses. This presentation discusses recent advances in generating organoids from induced pluripotent stem cells (iPSCs) and adult stem cells for applications in neurology, gastroenterology, oncology, and infectious diseases. Brain, intestinal, liver, kidney, and lung organoids have enabled researchers to investigate complex disease mechanisms that were previously difficult to study using animal models.

Patient-derived organoids are also becoming increasingly important in personalized medicine by allowing clinicians to evaluate individual responses to chemotherapy,

immunotherapy, and targeted drugs before treatment begins. Integration with CRISPR gene-editing technology further enables researchers to model inherited disorders and identify novel therapeutic targets. Current limitations include variability in organoid maturation, vascularization, long-term maintenance, and standardization of manufacturing protocols. Future developments involving bio printing, microfluidic systems, and artificial intelligence are expected to improve organoid complexity and clinical utility. Stem cell-derived organoids represent a major step toward precision medicine and have the potential to reduce reliance on animal experimentation while accelerating therapeutic discovery.

Biography

Elena Rossi is an Associate Professor of Developmental Biology at the University of Milan. Her research focuses on stem cell-derived organoids, tissue engineering, and personalized regenerative medicine, with over 90 scientific publications.