Glioma organoids

- Optimizing GBM organoid construction with hydrogel-based models: GelMA-HAMA scaffold supports GBM organoids with clonal growth for drug screening
- Profiling Glioma Stem Cell Dynamics via 3D-Based Cell Cycle Reporter Assays
- Cholinergic neuron-to-glioblastoma synapses in a human iPSC-derived co-culture model
- Brain metastasis organoids: A systematic review of their methods and clinical application
- Novel GABAAR antagonists target networked gene hubs at the leading-edge in high-grade gliomas
- Functional Characterization of LTR12C as Regulators of Germ-Cell-Associated TA-p63 in U87-MG and T98-G In Vitro Models
- Combined inhibition by PRMT5 and MAT2A demonstrates a strong synthetic lethality in MTAP homozygous-deficient glioma models
- Use of Tissue Specimens from Stereotactic Biopsies for Patient-Derived GBM Organoid-Based Drug Testing

Glioma organoids are three-dimensional in vitro models that mimic the architecture and cellular complexity of gliomas.

A biobank of patient-derived glioma organoids is a valuable resource for cancer research, particularly for studying gliomas, which are aggressive brain tumors. Glioma organoids are 3D cell cultures derived from patients' tumor cells, closely mimicking the tumor's native environment, including its heterogeneity and interaction with the surrounding microenvironment. These organoids offer a more accurate model for studying tumor biology, drug responses, and personalized medicine approaches.

Key Aspects of a Glioma Organoid Biobank

Patient-Derived: Tumor samples are obtained from patients during surgeries or biopsies, ensuring that the organoids represent the diversity of glioma subtypes and stages.

3D Culture Systems: The organoids are grown in 3D conditions, which better recapitulate the complex architecture of gliomas, compared to traditional 2D cultures.

Genetic and Molecular Fidelity: Glioma organoids maintain key genetic mutations, molecular signatures, and phenotypic features of the original tumors. This makes them useful for studying disease mechanisms at a patient-specific level.

Applications:

Drug Screening: Researchers can test various therapies on these organoids to predict how a patient’s tumor might respond, leading to more personalized treatment strategies. Mechanistic Studies: Organoids can be used to study the molecular and cellular mechanisms of glioma progression, invasion, and resistance to therapy. Preclinical Models: Glioma organoids serve as models for validating potential drug candidates before clinical trials. Personalized Medicine: Because these organoids are patient-specific, they allow for the testing of individualized treatment plans, helping to

tailor therapies to a patient's unique tumor characteristics.

Cryopreservation and Accessibility: Organoids can be cryopreserved and stored in the biobank for future research, making them a renewable resource. A biobank ensures standardized access to well-characterized glioma models for academic and clinical research teams.

This type of biobank is a crucial tool in advancing glioma research and improving treatment outcomes [1)]

They have been used to study tumor biology and drug response, and are progressively being applied to investigate other neurosurgery-associated diseases [2)]

They can also be used more accurately than traditional cell lines.

The use of organoids in cancer research is part of a broader effort to improve the translatability of preclinical studies to clinical outcomes.

A review focuses on the development of various GBM organoid models and their applications in identifying new individualized therapies against drug-resistant GBM [3)].

The intra- and inter-tumoral heterogeneity of gliomas and the complex tumor microenvironment make accurate glioma treatment challenging. At present, research on gliomas mainly relies on cell lines, stem cell tumor spheres, and xenotransplantation models. The similarity between traditional tumor models and patients with glioma is very low.

Zhang et al. aimed to address the limitations of traditional tumor models by generating patient-derived glioma organoids using two methods that summarized the cell diversity, histological features, gene expression, and mutant profiles of their respective parent tumors and assess the feasibility of organoids for personalized treatment.

They compared the organoids generated using two methods growth analysis, immunohistological analysis, genetic testing, and the establishment of xenograft models.

Both types of organoids exhibited rapid infiltration when transplanted into the brains of adult immunodeficient mice. However, organoids formed using the microtumor method demonstrated more similar cellular characteristics and tissue structures to the parent tumors. Furthermore, the microtumor method allowed for faster culture times and more convenient operational procedures compared to the Matrigel method.

Patient-derived glioma organoids, especially those generated through the microtumor method, present a promising avenue for personalized treatment strategies. Their capacity to faithfully mimic the cellular and molecular characteristics of gliomas provides a valuable platform for elucidating

tumor biology and evaluating therapeutic modalities.

The success rates of the Matrigel and microtumor methods were 45.5% and 60.5%, respectively. The microtumor method had a higher success rate, shorter establishment time, more convenient passage and cryopreservation methods, better simulation of the cellular and histological characteristics of the parent tumor, and a high genetic guarantee [4].

1)
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