

Human Brain In Vitro Model for Drug Screening and Disease Modeling

A scalable human brain cell model provides high-accuracy drug permeability and toxicity screening to accelerate central nervous system drug discovery and reduce late-stage failures.

Pharmaceutical and biotech R&D teams face persistent bottlenecks in CNS drug development due to unreliable predictions of blood-brain barrier (BBB) permeability and neurotoxicity, resulting in high attrition rates and costly late-stage failures. Existing in vitro models, such as organoids and indirect BBB systems, often lack the physiological relevance and functional separation needed for accurate screening, while animal models are expensive and poorly predictive. This technology introduces a direct contact triculture human brain model that uniquely layers astrocytes, pericytes, and brain microvessel endothelial cells with brain parenchymal cells in a Transwell system, enabling distinct assessment of BBB integrity and neuronal or inflammatory responses. Compared to the status quo, this model delivers step-change improvements in predictive accuracy, functional validation (e.g., efflux transporter activity), and scalability, with demonstrated lower permeability coefficients and compatibility with standard lab workflows. The model is validated at the lab scale (TRL 4), reproducible, and ready for moderate-throughput screening. If adopted, it could accelerate CNS drug discovery, reduce reliance on animal testing, and enable more effective development of neurotherapeutics by pharma, CROs, and academic labs.

Technology Validation

- Lab-validated with reproducible results using standard cell lines and Transwell systems.
- Demonstrated lower permeability coefficients (e.g., P_{eff} for 4kD dextran: 3.7×10^{-6} cm/sec) versus monoculture/coculture models.
- Functional activity of key efflux transporters (P-gp, BCRP) confirmed.

Advantages

Technology ID

2026-KNIP-71289

Category

Materials Science &
Nanotechnology/Biomedical &
Bioinspired Materials
Pharmaceuticals/Research Tools
& Assays

Authors

Gregory Thomas Knipp
Zhuangyan Xu
Grace Coomes

Further information

Joe Kasper
JRKasper@prf.org

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- Closely mimics human neurovascular unit for superior physiological relevance.
- Distinct separation of BBB and neuronal/inflammatory responses for targeted screening.
- Compatible with existing lab equipment and scalable for moderate-throughput studies.
- Reduces reliance on animal models, supporting cost and ethical goals.

Applications

- CNS drug permeability and neurotoxicity screening by pharma and biotech R&D.
- Disease modeling for neurodegenerative and neurodevelopmental disorders.
- Phenotypic screening and validation of neurotherapeutics.
- Integration into CRO and academic research platforms for preclinical studies.
- Toxicology and excipient assessment for drug delivery R&D.

TRL: 4

Intellectual Property:

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