

SynBBB™: AI/ML-enhanced standardization and predictive monitoring of a human-relevant blood-brain barrier-on-chip for CNS drug discovery

AI-based lumen readiness scoring identifies compromised channels before dosing and reflects barrier function

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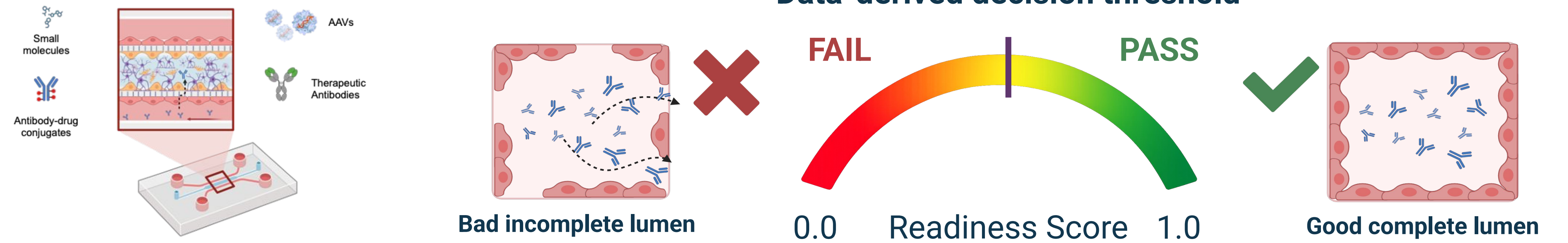


Abstract #550

1 The Challenge: Lumen Integrity Affects BBB Assay Reliability

The blood-brain barrier (BBB) controls drug entry into the central nervous system (CNS) and is critical for predictive in vitro testing. A continuous endothelial lumen is essential for robust barrier function in BBB-on-chip assays.

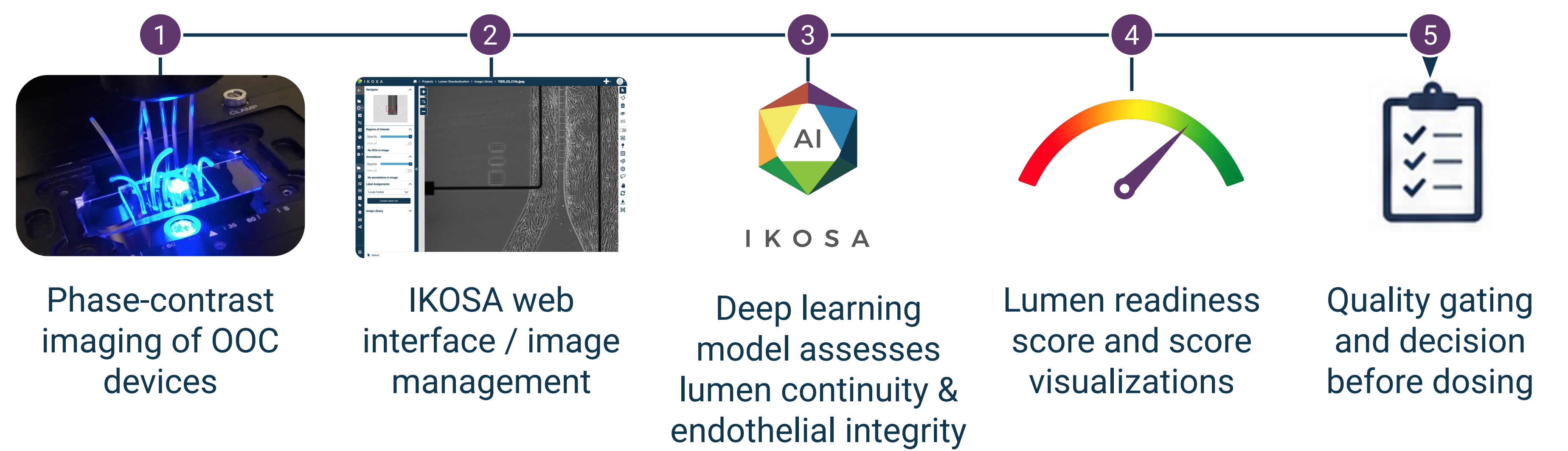
Incomplete lumenization or structural defects can increase leakiness, introduce variability, and compromise permeability measurements.



2 SynBBB™ Platform & AI-Based Readiness Workflow

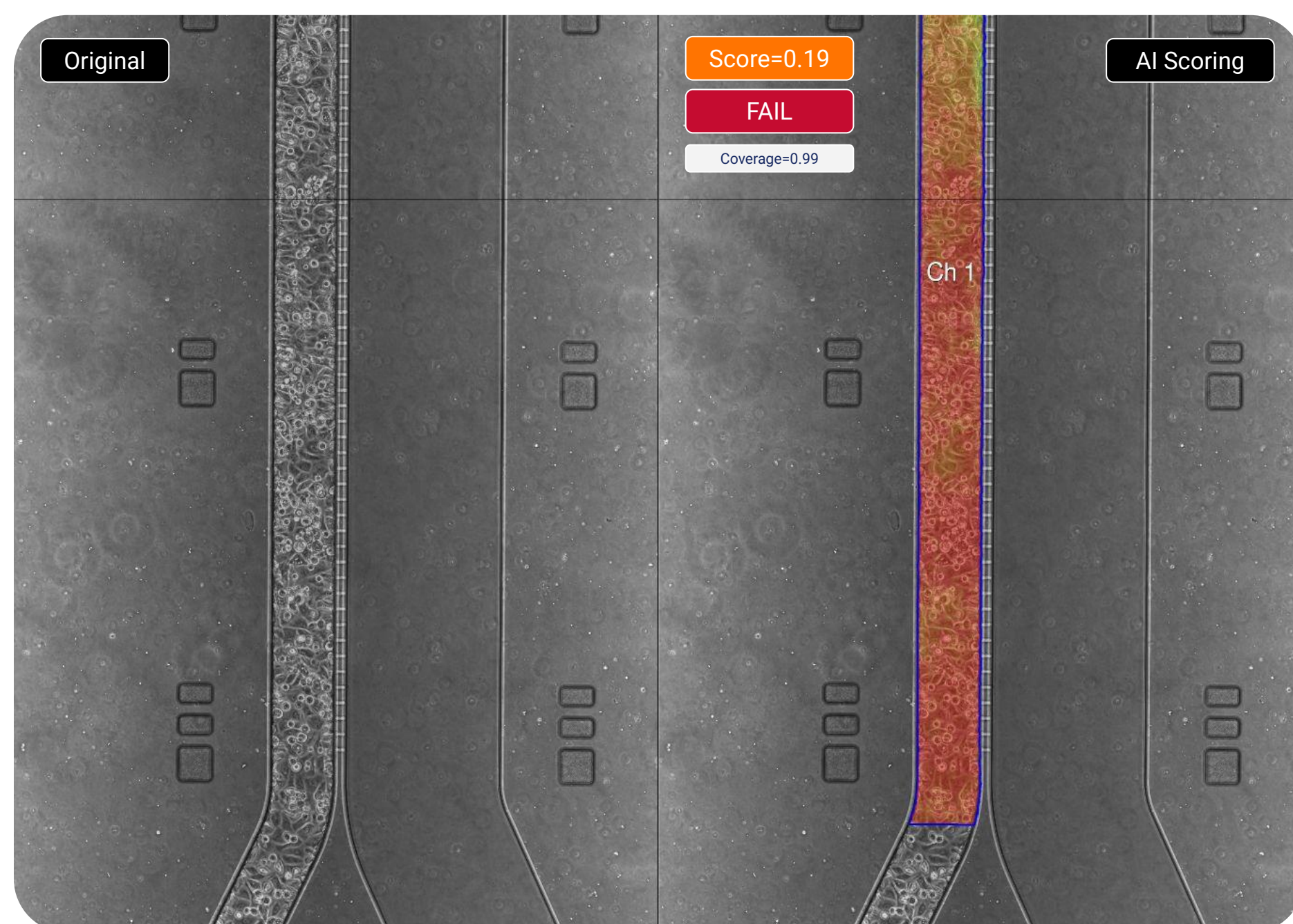


A perfused human BBB-on-chip platform using vascularized microfluidic channels digitized from real microvasculature, supporting permeability and barrier integrity studies under flow.

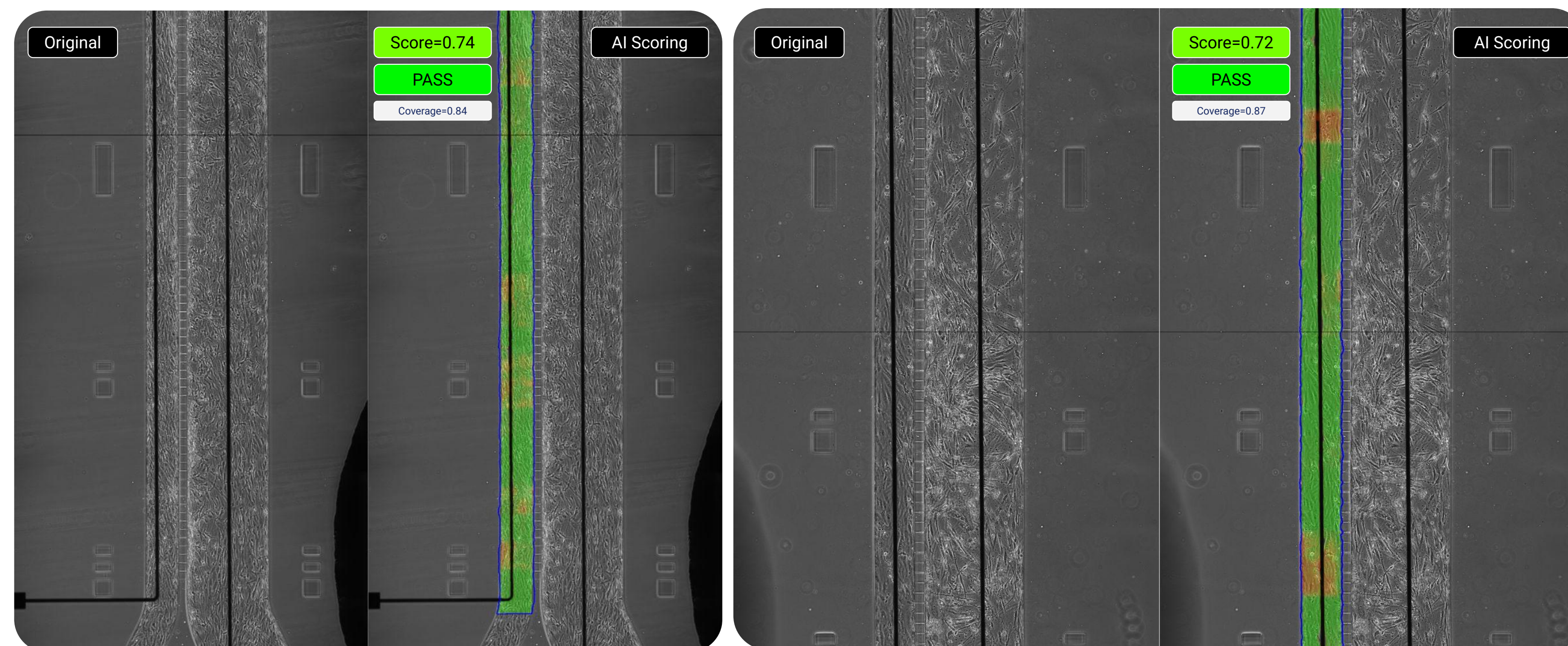


3 Lumen Readiness Results Across Multiple Chip Formats

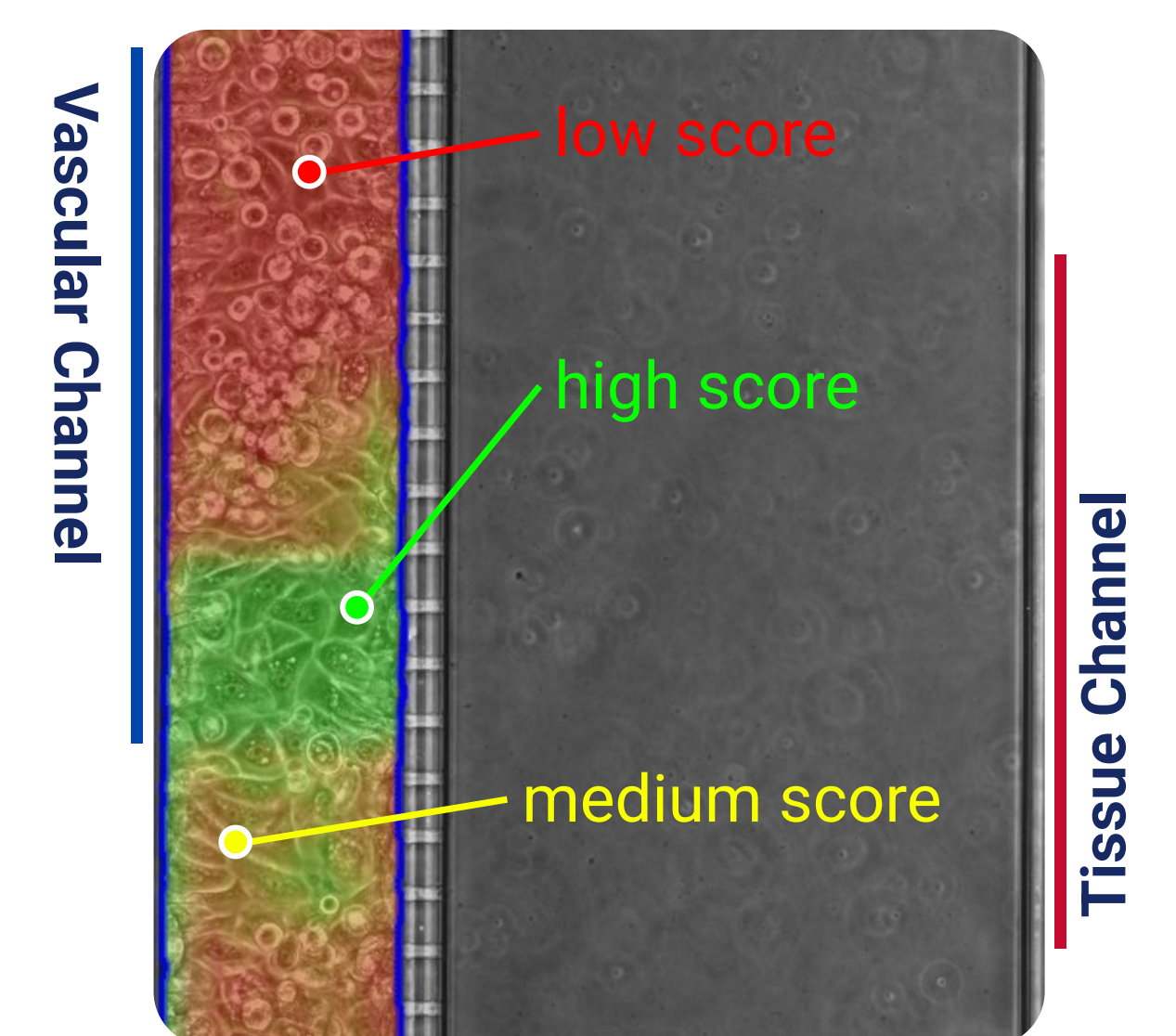
Linear chip design, 1 vascular channel



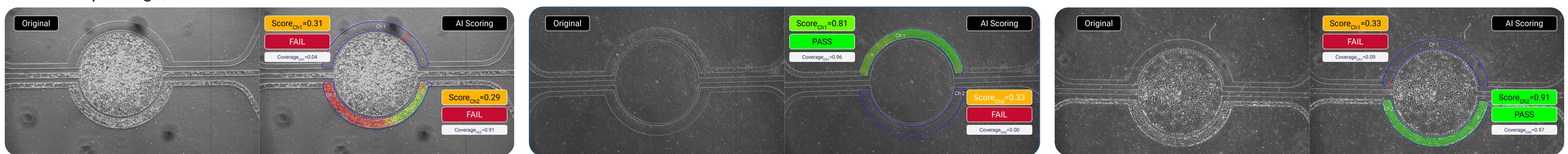
Linear chip design, TEER-enabled



Score integrates morphological patterns associated with lumen continuity and endothelial integrity.



Radial chip design, 2 vascular channels



4 Conclusions, Key Takeaways & Assays for Therapeutic Analysis

Predictive and non-invasive

Scoring can be reapplied post-dosing to detect drug-induced barrier disruption, enables continuous label-free monitoring over time.

AI-enhanced data integrity

Integrated quality gating and predictive monitoring improve experimental reliability and reduce variability. Stable performance across different chip layouts.

Scalable, data-driven quality control

Data-driven AI/ML pipeline that can be easily trained for other microphysiological systems or assay types, enabling broad reuse and rapid adaptation across applications.

Translational and ethical impact

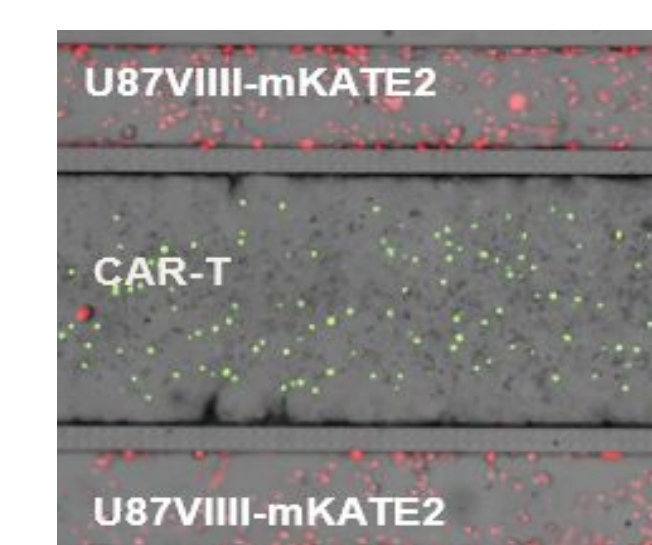
SynBBB™ supports more predictive CNS drug discovery while minimizing reliance on animal testing.

Commercial availability

Application available as Lumen Standardization app on the IKOSA image analysis platform.

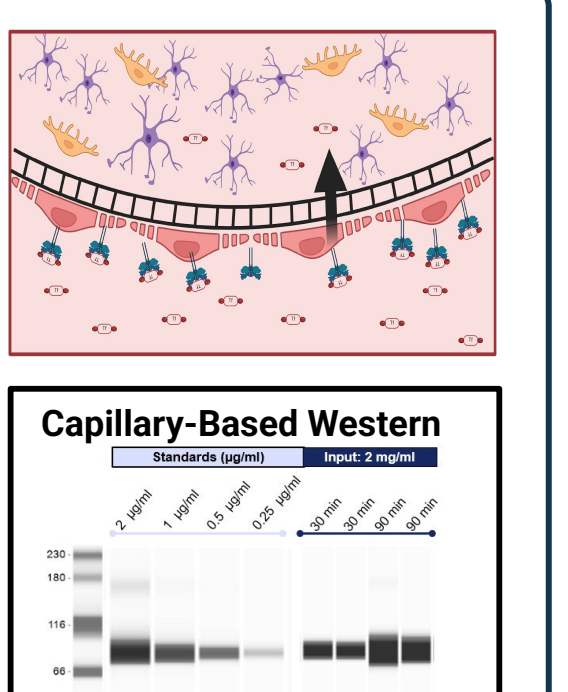
CAR-T Screening

SynBBB™ allows visualization of CAR-T cell extravasation across blood-brain tumor barrier.

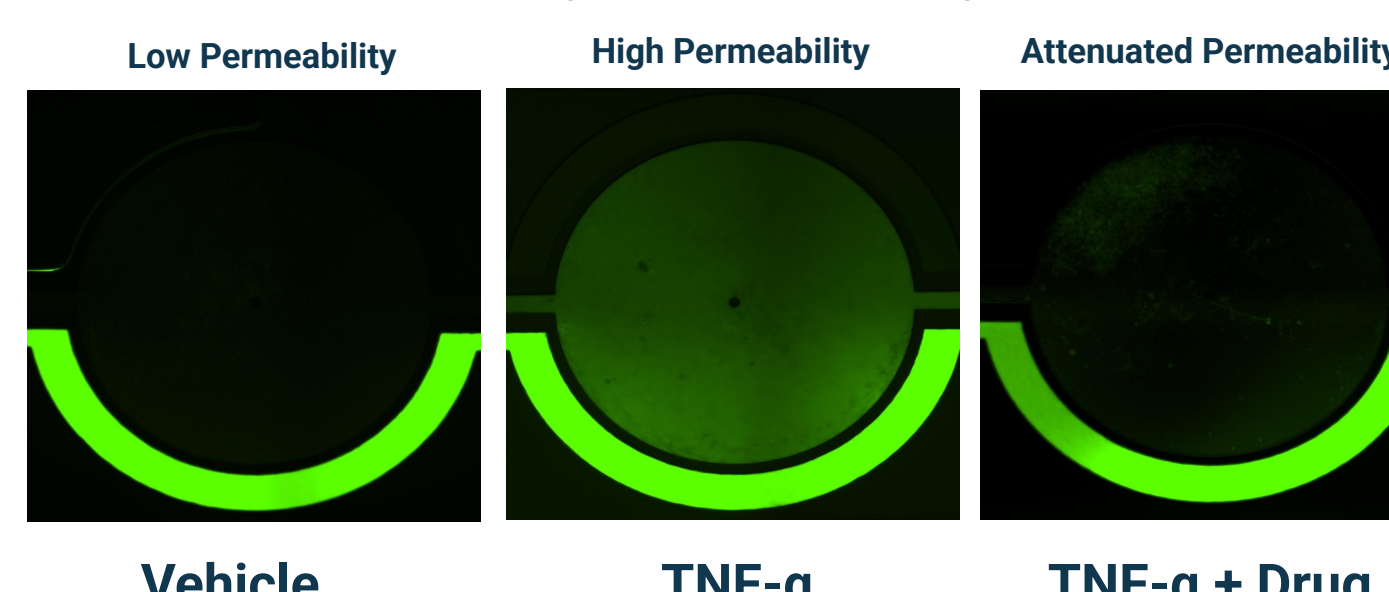


Drug Permeability and Receptor-Mediated Transcytosis: From Small Molecules to Antibodies and AAV Viruses

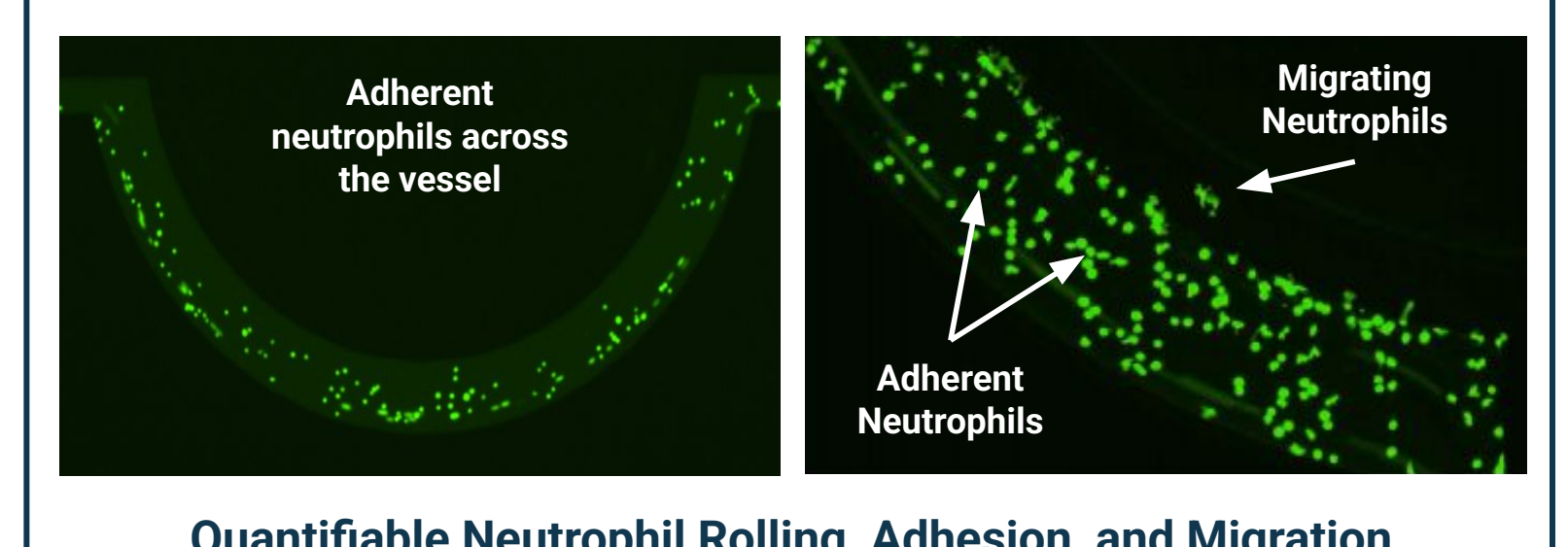
SynBBB™ allows collection and quantification of transcytosed compounds across the BBB via automated WES and qPCR



Barrier Integrity Assays for Drug Safety and Efficacy Testing



Leukocyte Adhesion Assay To Detect Inflammation



5 References, Contacts & Resources

[1] Charlebois C, Huang J, Sodja C, Ribocco-Lutkiewicz M, Baumann E, Stanimirovic DB, Jezierski A. Development of a Blood-Brain Barrier Permeability Assay Using Human Induced Pluripotent Stem Cell Derived Brain Endothelial Cells. *Methods Mol Biol.* 2022;2454:397-410. PMID: 33881753.
 [2] Sade H, Baumgartner C, Hugenmatter A, Moessner E, Freskgård PO, Niewoehner J. A human blood-brain barrier transcytosis assay reveals antibody transcytosis influenced by pH-dependent receptor binding. *PLoS One.* 2014 Apr 30;9(4):e96340. PMID: 24788759; PMCID: PMC4005765.

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