FRUZSINA WALTER

HUN-REN Biological Research Centre
Institute of Biophysics
Biological Barriers Research Group

Address: Temesvári krt. 62., H-6726 Szeged, Hungary

RESEARCH AREA

I am a dedicated senior research associate specializing in blood-brain barrier physiology, pathology and pharmacology. Our team employs cutting-edge in vitro microelectronic biochip models to study brain microvessels in both healthy and disease conditions. Our research aims to identify protective agents that preserve brain endothelial cell function in pathologies, we also explore the role of the surface glycocalyx at the blood-brain barrier. Testing protective agents, the transport of molecules across he blood-brain barrier is a default task. We also seek innovative strategies to enhance drug delivery to the brain. Recently, we have expanded our focus to integrate our advanced in vitro models with brain organoid technology.

TECHNIQUES AVAILABLE IN THE LAB

Under my guidance, students can acquire fundamental sterile cell culture techniques. Our work extends to handling stem cell-derived cells and maintaining primary isolated cells. We construct complex in vitro blood-brain barrier models, providing insights not only into working with brain endothelial cells but also with pericytes and astroglia. Students gain imaging experience using phase contrast microscopy and advanced fluorescence microscopy. We assess molecular transport across brain endothelial cells through resistance measurements and permeability assays. To investigate pathological processes, we conduct various cell viability tests, measure reactive oxygen species (ROS) release, and analyze mitochondrial network alterations. In addition to functional assays, we perform gene expression and protein expression analyses. Through biochip-based measurements, students are also introduced to more advanced biophysical assessments. By measuring cell surface charge and visualizing glycocalyx components, we obtain a comprehensive view of cellular conditions.

SELECTED PUBLICATIONS

Walter, F. R., Harazin, A., Tóth, A. E., Veszelka, S., Santa-Maria, A. R., Barna, L., Kincses, A., Biczó, G., Balla, Z., Kui, B., Maléth, J., Cervenak, L., Tubak, V., Kittel, Á., Rakonczay, Z. Jr., Deli, M. A. (2022). Blood–brain barrier dysfunction in L-ornithine induced acute pancreatitis in rats and the direct effect of L-ornithine on cultured brain endothelial cells. **Fluids Barriers CNS 19(1):** 16.

Petrovszki, D., **Walter, FR.**, Vigh, JP., Kocsis, A., Valkai, S., Deli, MA., Dér, A. (2022) Penetration of the SARS-CoV-2 Spike Protein across the Blood-Brain Barrier, as Revealed by a Combination of a Human Cell Culture Model System and Optical Biosensing. **Biomedicines 10(1):** 188.

Walter, FR., Santa-Maria, AR., Mészáros, M., Veszelka, S., Dér, A., Deli, MA. (2021) Surface charge, glycocalyx, and blood-brain barrier function. **Tissue Barriers 9(3):** 1904773.

Santa-Maria, AR., Walter, FR., Figueiredo, R., Kincses, A., Vigh, JP., Heymans, M., Culot, M., Winter, P., Gosselet, F., Dér, A., Deli, MA. (2021) Flow induces barrier and glycocalyx-related genes and negative surface charge in a lab-on-a-chip human blood-brain barrier model. **J Cereb Blood Flow Metab 41(9):** 2201-2215.

Walter, FR., Valkai, S., Kincses, A., Petneházi, A., Czeller, T., Veszelka, S., Ormos, P., Deli, MA., Dér, A. (2016) A versatile lab-on-a-chip tool for modeling biological barriers. **Sens Actuators B Chem 222:** 1209-1219.