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RESEARCH AREA

The pharmaceutical treatment of central nervous system disorders is far from satisfactory due to the poor penetration of drugs to the brain tissue. The blood-brain barrier is the major obstacle to prevent potential neuropharmaceuticals to reach their targets. Nanosized drug carriers, or nanoparticles are in the focus of research efforts to develop successful drug delivery systems for the central nervous system. Drug loading to nanoparticles alone is not enough for successful delivery of drugs to the brain. In order to elevate the permeability of nanocarriers across the blood-brain barrier a specific targeting is needed. Influx transport systems are highly expressed on the cerebral endothelium in contrast to blood vessel endothelial cells of other organs. Nanoparticles targeted by the ligands of these transporters may better dock to the luminal surface of brain microvascular endothelial cells resulting in better cellular uptake into the cells and penetration of the cargo across the blood-brain barrier.

Blood-brain barrier dysfunction and inflammation play central role in the pathomechanism of many central nervous system disorders. Protection of the blood-brain barrier, the inhibition of causal factors of the brain microvascular breakdown offers an innovative therapeutic target of brain diseases. Several studies confirm that long-term treatment with non-steroidal anti-inflammatory drugs such as ibuprofen reduces the risk of Alzheimer's disease by the inhibition of inflammatory cascades. The serious peripheral side effects of long-term administration of ibuprofen limits its clinical applicability. Formulation of ibuprofen with targeted nanocarriers increases the brain specific penetration of the drug and at the same time reduces treatment doses and peripheral side-effects. The expected new results contribute to the development of new targeted nanocarrier systems for better brain delivery of drugs and to prevent and treat the diseases of central nervous system.

TECHNIQUES AVAILABLE IN THE LAB

Preparation of nanoparticles and their characterization by zeta potential, size, encapsulation efficiency measurements. In vitro mammalian cell culture, isolation of primary brain endothelial cells, models of biological barriers by double and triple co-cultures. Cellular toxicity measurements (MTT/LDH tests, double cell nuclei staining, real-time cell monitoring assay), electrical resistance measurements on barrier models, cell uptake and blood-brain barrier transport experiments for drugs and nanoparticles, immunohistochemistry, confocal microscopy, scanning electron microscopy, spectrofluorometry measurements.

SELECTED PUBLICATIONS

Veszelka, S., **Mészáros, M.**, Porkoláb, G., Szecskó, A., Kondor, N., Ferenc, G., Polgár, T.F., Katona, G., Kóta, Z., Kelemen, L., Páli, T., Vigh, J.P., Walter, F.R., Bolognin, S., Schwamborn, J.C., Jan, J.S., Deli, M.A. (2022) A triple combination of targeting ligands increases the penetration of nanoparticles across a blood-brain barrier culture model. **Pharmaceutics 14:** 86.

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Porkoláb, G., **Mészáros, M.**, Tóth, A., Szecskó, A., Harazin, A., Szegletes, Z., Ferenc, G., Blastyák, A., Mátés, L., Rákhely, G., Deli, M.A., Veszelka, S. (2020) Combination of Alanine and Glutathione as Targeting Ligands of Nanoparticles Enhances Cargo Delivery into the Cells of the Neurovascular Unit. **Pharmaceutics 12:** 635.

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