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RESEARCH AREA

A critical yet often underrecognized factor in the development and progression of neurodegenerative diseases is the impaired function of the blood-brain barrier. Once compromised, it allows harmful substances and inflammatory markers to infiltrate the brain or hinders the clearance of toxic molecules that can accumulate in the brain. Understanding and preserving blood-brain barrier integrity is therefore not only essential for disease prevention but also represents a promising target for therapeutic intervention. We study natural compounds and synthetic derivatives for their pharmacological properties, focusing on blood brain barrier protection, with the goal to use these compounds to prevent disease development or slow down disease progression.

As a parallel research area, we are also interested in drug resistance and adjuvant therapy of drug-resistant cancer and bacteria.

TECHNIQUES AVAILABLE IN THE LAB

- In vitro cell culture,
- Toxicity measurements (MTT/LDH tests, and real-time cell impedance assay),
- Primary and IPSC-derived Blood brain barrier (BBB) models
- BBB resistance measurements
- BBB transport experiments,
- Characterization of the models using immunohisto-chemistry, western blot, microscopy, or spectrofluoro-meter measurements.
- Determination of membrane potential using zeta potential measurements.

SELECTED PUBLICATIONS

Martins, A., Judák, F., Farkas, Z., Szili, P., Grézal, G., Csörgő, B., Czikkely, M. S., Maharramov, E., Daruka, L., Spohn, R., Balogh, D., Daraba, A., Juhász, S., Vágvölgyi, M., Hunyadi, A., Cao, Y., Sun, Z., Li, X., Papp, B., & Pál, C. (2025). Antibiotic candidates for Gram-positive bacterial infections induce multidrug resistance. **Sci Transl Med 17(780):** eadl2103.

Vágvölgyi, M., Kocsis, E., Tayeb, B. A., Zupkó, I., Minorics, R., **Martins, A.**, Hoyk, Z., Ballai, G., Szenti, I., Kónya, Z., Gáti, T., Bogdán, D., Tóth, G., & Hunyadi, A. (2025). Ecdysteroid-Containing Squalenoylated Self-Assembling Nanoparticles Exert Tumor-Selective Sensitization to Reactive Oxygen Species (ROS)-Induced Oxidative Damage While Protecting Normal Cells: Implications for Selective Radiotherapy. **J Med Chem 68(7):** 7197–7212.

Bhaumik, K. N., Hetényi, A., Olajos, G., **Martins, A.**, Spohn, R., Németh, L., Jojart, B., Szili, P., Dunai, A., Jangir, P. K., Daruka, L., Földesi, I., Kata, D., Pál, C., & Martinek, T. A. (2021). Rationally designed foldameric adjuvants enhance antibiotic efficacy via promoting membrane hyperpolarization. **Mol Syst Des Eng 7(1):** 21–33.

Spohn, R., Daruka, L., Lázár, V., **Martins, A.**, Vidovics, F., Grézal, G., Méhi, O., Kintses, B., Számel, M., Jangir, P. K., Csörgő, B., Györkei, Á., Bódi, Z., Faragó, A., Bodai, L., Földesi, I., Kata, D., Maróti, G., Pap, B., Wirth, R., … Pál, C. (2019). Integrated evolutionary analysis reveals antimicrobial peptides with limited resistance. **Nat Commun 10(1):** 4538.

Kintses, B., Kumar Jangir P., Fekete, G,, Számel, M., Méhi, O., Spohn, R., Daruka, L., **Martins, A.**, Hosseinnia, A., Gagarinova, A., Kim, S., Phanse, S., Csörgő, B., Györkei, Á., Ari, E., Lázár, V., Faragó, A., Bodai, L., Nagy, I., Babu, M., Pál, C., Papp, B. (2019). Chemical-genetic profiling reveals cross-resistance and collateral sensitivity between antimicrobial peptides. **Nat Commun 10:** 5731.

Lázár, V., **Martins, A.**, Spohn, R., Daruka, L., Grézal, G., Fekete, G., Számel, M., Jangir, P. K., Kintses, B., Csörgő, B., Nyerges, Á., Györkei, Á., Kincses, A., Dér, A., Walter, F. R., Deli, M. A., Urbán, E., Hegedűs, Z., Olajos, G., Méhi, O., … Pál, C. (2018). Antibiotic-resistant bacteria show widespread collateral sensitivity to antimicrobial peptides. **Nat Microbiol 3(6):** 718–731.