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RESEARCH AREA

1. With the extending life expectancy, various degenerative diseases associated with pathological protein aggregation—such as Alzheimer's and Parkinson's disease—pose increasingly serious problems. We investigate the structure of the different protein aggregates involved, the conditions under which they form, the mechanism and kinetics of aggregation, its thermodynamic background, as well as possible strategies for inhibiting protein aggregation.

2. We develop methods for determining the structure of proteins and nucleic acids using spectroscopic techniques. These methods are of particular importance when 3D structural determination by X-ray crystallography or NMR is not feasible, or when we aim to rapidly and cost-effectively assess the effects of solution conditions (temperature, pH, ionic strength, presence of additives), verify the native structure of recombinant proteins, or study the impact of mutations and post-translational modifications.

3. We study the role of the complement system, a component of innate immunity, in the brain, specifically in the elimination of synapses, a process that may become pathological in various psychiatric and neurodegenerative disorders.

TECHNIQUES AVAILABLE IN THE LAB

Fundamental biochemical and molecular biology methods, protein expression and purification, circular dichroism-, infrared- and fluorescence spectroscopy, molecular interaction analysis techniques (isothermal titration calorimetry, surface plasmon resonance, bio-layer interferometry, fluorescence polarization), synaptosome preparation, proteomic methods (e.g., 2D-differential gel electrophoresis), and immunohistochemistry.

SELECTED PUBLICATIONS

Györffy, B. A., Kun, J., Török, G., Bulyáki, É., Borhegyi, Z., Gulyássy, P., Kis, V., Szocsics, P., Micsonai, A., Matkó, J., Drahos, L., Juhász, G., Kékesi, K. A., & **Kardos, J.** (2018). Local apoptotic-like mechanisms underlie complement-mediated synaptic pruning. **Proc Natl Acad Sci U S A 115(24):** 6303–6308.

Kardos, J., Nyiri, M. P., Moussong, É., Wien, F., Molnár, T., Murvai, N., Tóth, V., Vadászi, H., Kun, J., Jamme, F., & Micsonai, A. (2025). Guide to the structural characterization of protein aggregates and amyloid fibrils by CD spectroscopy. **Protein Sci 34(3):** e70066.

Micsonai, A., Wien, F., Murvai, N., Nyiri, M. P., Balatoni, B., Lee, Y. H., Molnár, T., Goto, Y., Jamme, F., & **Kardos, J.** (2025). BeStSel: analysis site for protein CD spectra-2025 update. **Nucleic Acids Res 53(W1):** W73–W83.

Murvai, N., Gellen, G., Micsonai, A., Schlosser, G., & **Kardos, J.** (2023). Cross-Linked α-Synuclein as Inhibitor of Amyloid Formation. **Int J Mol Sci 24(17):** 13403.

Tóth, V., Vadászi, H., Ravasz, L., Mittli, D., Mátyás, D., Molnár, T., Micsonai, A., Szaniszló, T., Lőrincz, P., Kovács, R. Á., Juhász, T., Beke-Somfai, T., Juhász, G., Györffy, B. A., Kékesi, K. A., & **Kardos, J.** (2022). Neuronal-specific septin-3 binds Atg8/LC3B, accumulates and localizes to autophagosomes during induced autophagy. **Cell Mol Life Sci 79(9):** 471.