(U*) The Effects of Resveratrol, Caffeine, ⬛-Carotene, and Epigallocatechin Gallate (EGCG) on Amyloid-⬛25−35 Aggregation in Synthetic Brain Membranes

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Alzheimer's disease is a neurodegenerative condition marked by the formation and aggregation of amyloid-⬛ (A⬛) peptides. It is the most common cause of dementia worldwide, with numbers expected to double each year, reaching 81 million by 2040. There exists, to this day, no cure or effective prevention for the disease; however, there is evidence that a nutritious diet and certain food compounds can slow down first occurrence and progression of the disease. Here, we prepared synthetic membranes that contained A⬛ aggregates and investigated if certain food compounds could partition into the membrane and interact with such aggregates using optical and fluorescence microscopy, X-ray diffraction, UV–vis spectroscopy, and molecular dynamics simulations. The compounds studied were resveratrol, a polyphenol commonly found in the skin of grapes, ⬛-carotene, a naturally occurring carotenoid found in carrots, EGCG, an antioxidant abundantly found in green tea, and caffeine, the principal pharmacologically active component in coffee [1].

Evidence suggests that all compounds are membrane active and spontaneously partitioned in the membrane. While resveratrol and caffeine lead to membrane thickening and reduced membrane fluidity, ⬛-carotene and EGCG preserved or increased fluidity. Our findings show that resveratrol and caffeine did not reduce the volume fraction of peptide aggregates while ⬛-carotene significantly reduced plaque size. Additionally, EGCG dissolved peptide aggregates and significantly decreased the corresponding cross-⬛ and ⬛-sheet signals. The results of this paper provide a mechanism by which food compounds may affect amyloid-⬛ aggregation and may be useful in future research by providing candidates that target the membrane environment and in turn, potentially inhibit or reverse the formation of amyloid aggregates.

[1] Gastaldo, Isabella P., Sebastian Himbert, Udbhav Ram, and Maikel C. Rheinstädter. "The Effects of Resveratrol, Caffeine, ⬛-Carotene, and Epigallocatechin Gallate (EGCG) on Amyloid-⬛25–35 Aggregation in Synthetic Brain Membranes." Mol. Nutr. Food Res 2000632 (2020).

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