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Nanoalgosomes as Drug Delivery System for Neuroprotective Drugs in C. Elegans Model of Spinal Muscular Atrophy (sma)

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A challenging issue in the field of nanotechnology is the development of nanocarriers aimed to improve the effectiveness of drugs by addressing specific issues like limited targeting, excessive side effects, degradation, and the need for high doses. Extracellular vesicles (EVs) are a natural heterogeneous group of lipid nanoparticles secreted by cells and involved in multiple physiological and pathological processes. Here we exploit the unique properties in terms of biocompatibility and bioavailability of EVs derived from the microalgae Tetraselmis chuii, named nanoalgosomes, to load neuroprotective compounds capable of mitigating Spinal Muscular Atrophy (SMA) related neurodegeneration in C. elegans. SMA is a genetic disease causing motoneuron loss and severe dysfunctions. Neuroprotective compounds have been effectively encapsulated into EVs using active loading treatments and subsequently purified using size exclusion chromatography. The nanosystems were characterized by different biophysical and biochemical techniques, including fluorescence to quantify the loaded cargo. In vivo testing on a C. elegans SMA model has revealed that neuroprotective compounds encapsulated within EVs exhibit greater efficacy compared to free drugs. This emphasizes the enhancement of neuroprotective drug efficacy with a drastic reduction of active dose through nanoalgosome encapsulation.