# Neural stem cell-derived extracellular vesicle

Neural stem cell-derived extracellular vesicles (NSC-EVs) are small membranous structures released by neural stem cells (NSCs) that contain a variety of bioactive molecules, including proteins, nucleic acids, and lipids. These extracellular vesicles play a significant role in intercellular communication within the nervous system and have garnered significant interest in both research and potential therapeutic applications. Here are some key points about NSC-EVs:

Origin: NSCs are specialized cells found in the central nervous system (CNS) that have the capacity to self-renew and differentiate into various neural cell types, including neurons, astrocytes, and oligodendrocytes. NSCs release extracellular vesicles as a means of communication with neighboring cells.

Composition: NSC-EVs contain a diverse cargo of molecules, such as microRNAs, messenger RNAs, proteins, and lipids. These molecules can modulate cellular processes and gene expression in target cells.

Function: NSC-EVs play several essential roles in CNS homeostasis and repair:

Neuroprotection: NSC-EVs can protect neurons from damage and promote their survival. Neurogenesis: They can stimulate the generation of new neurons from NSCs or progenitor cells. Anti-inflammatory Effects: NSC-EVs have anti-inflammatory properties and can help modulate immune responses in the CNS. Axon Growth and Regeneration: They may promote axon growth and regeneration after injury. Myelination: NSC-EVs can stimulate the formation of myelin, the protective sheath around nerve fibers, which is important for proper neural function. Therapeutic Potential: Because of their ability to influence various cellular processes and promote neural repair, NSC-EVs have attracted attention as potential therapeutic agents for neurodegenerative diseases, stroke, traumatic brain injuries, and other neurological disorders. Research is ongoing to harness their therapeutic potential effectively.

Delivery: One challenge in utilizing NSC-EVs therapeutically is the efficient and targeted delivery to specific areas of the CNS. Researchers are exploring various delivery methods, including intranasal administration, intrathecal injection, and direct injection into the brain, to ensure the vesicles reach their intended targets.

Safety and Regulatory Considerations: As with any potential therapeutic approach, safety and regulatory considerations are essential. Researchers are conducting preclinical studies to assess the safety profile of NSC-EV-based therapies and navigate regulatory pathways for clinical applications.

In summary, neural stem cell-derived extracellular vesicles are emerging as promising tools in the field of neurobiology and neuroregeneration. Their diverse cargo and ability to modulate various cellular processes make them attractive candidates for developing novel treatments for neurological disorders. However, further research is needed to better understand their mechanisms of action and optimize their therapeutic use.

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Depression is a common mental illness. Neural stem cell-derived extracellular vesicles (NSC-EVs) are involved in repairing neuronal injury. We estimated the mechanism of miR-16-5p in depression rats.

EVs were extracted from NSCs. The depression rat model was established by corticosterone (CORT) induction and treated with NSC-EVs. The depression behavioral/pathological changes in rats were assessed using forced swimming test, open field test, sucrose consumption test and western blotting. The neuronal apoptosis in hippocampal tissue were detected. CORT-induced PC12 cell model was established. EV uptake by PC12 cells was measured and PC12 cell apoptosis was detected. The downstream targets of miR-16-5p were predicted and verified. The expressions of miR-16-5p and MYB in rats, PC12 cells, and EVs were measured. Functional rescue experiments were conducted to verify the role of miR-16-5p and MYB in PC12 cell apoptosis.

CORT induction increased neuronal apoptosis in hippocampal tissue and induced depression-like behaviors in rats, while NSC-EV treatment improved depression-like behaviors and apoptosis in rats. In PC12 cells, NSC-EVs decreased CORT-induced PC12 cell apoptosis. NSC-EVs carried miR-16-5p into PC12 cells. miR-16-5p knockdown in EVs partially reversed the inhibitory effects of NSC-EVs on CORT-induced PC12 cell apoptosis. miR-16-5p targeted to inhibit MYB to repress CORT-induced PC12 cell apoptosis. In vivo experiments further verified that NSC-EVs reduced neuronal injury in CORT-induced depression rats via the miR-16-5p/MYB axis.

NSC-EVs-mediated alleviation on neuronal injury by carrying miR-16-5p to target MYB was highly likely one of the mechanisms by which NSC-EVs mediated miR-16-5p in neuroprotection of depression rats [1)]

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Min XL, Liu HJ, Dou XK, Chen FX, Zhao Q, Zhao XH, Shi Y, Zhao QY, Sun SJ, Wang Z, Yu SH. Extracellular vesicles from neural stem cells carry microRNA-16-5p to reduce corticosterone-induced neuronal injury in depression rats. Neuroscience. 2023 Sep 29:S0306-4522(23)00440-2. doi: 10.1016/j.neuroscience.2023.09.016. Epub ahead of print. PMID: 37778691.