Biological nanoparticles-exosomes: novel restorative therapy for neurologic injury and disease

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We have demonstrated that the biological mechanisms underlying the efficacy of cell-based neurorestorative therapy for stroke and neurological injury are attributed to the cellular release of exosomes. Exosomes are nano-size bilipid layer particles released by nearly all cells. They contain proteins, mRNA, lipids and microRNAs (miRs). Thus, we have employed exosomes harvested from stem-like cells, e.g. multipotent mesenchymal stem cells (MSCs), umbilical cord blood cells, as well as other cells, for the subacute (-1 day) treatment of stroke, traumatic brain injury (TBI), peripheral neuropathy, and other neurodegenerative diseases. Here, I will focus on the use of exosomes harvested from MSCs for the treatment of stroke and TBI. I will demonstrate that the exosomes are highly efficacious in promoting neurovascular remodeling and subsequently enhancing functional recovery post stroke and TBI. Data will also be presented that miRs play a primary role in mediating the therapeutic benefit of exosome therapy. I will also show that exosomes may be engineered to contain specific miRs, which can amplify their therapeutic benefit. Likewise, externally administered exosomes, will be shown to evoke a chain reaction-like effect, by stimulating endogenous parenchymal cells to further release their own exosomes, which contribute to functional recovery and neurological outcome. Thus, exosome therapy represents a novel and potentially highly efficacious means to treat stroke and neural injury. Exosomes are superior to stem cells; they do not evoke any adverse effects, such as malignancy, or induce microvascularl occlusion, and, importantly, they can be designed to amplify targeted therapeutic benefit.