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Nanoparticles as alternate strategies for drug delivery into the brain

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One of the unsolved problems and challenges for the development of new drugs and treatment strategies against neurodegenerative diseases such as Alzheimer Disease (AD) and cancer is the crossing of target drugs into the blood brain barrier (BBB). The use of nanoparticles in drug delivery therapy holds much promise in targeting remote tissues, and as a result many studies have attempted to study the ultrastructural localization of nanoparticles in various tissues. However, there are currently no in vivo studies demonstrating the ultrastructural distribution of nanoparticles in the brain. The present study can be useful for the development of novel drug delivering therapy and useful in understanding the delivery, distribution and effects of silver nanoparticles in AD brain tissue at cellular and sub cellular level. Therefore, research interests focuses on investigating the interaction of nanoparticles with tissues and cells become one of the hottest topics. We have recently developed different ways to determine the biological effects of nanoparticles in vivo and in vitro by utilizing animal models of human diseases. Our goal is to not only elucidate the pathogenic mechanisms underlying the nanoparticles' effects, but also to discover potential new drug development strategies. The results from the current study showed that the intraperitoneal injection of silver nanoparticles in the brain leads to leaking on the inter-endothelial contact and luminal plasma membrane, thus elucidating the possibility of penetrating into the most affected areas in the Alzheimer brain (vascular endothelium, perivascular, neuronal and glial cells). Moreover, our results also suggest that the silver nanoparticles reached the brain and were found in hippocampal areas, indicating that they can be conjugated and used to deliver the drugs into the cell cytoplasm of the damaged brain cells. These observations indicate the potential possibility the specific delivery of drugs to posttraumatic brain injury, tumor and animal model that mimics human neurodegeneration and cancer. In another of our in vivo studies, we are using classical biochemistry, cell biology, and morphology techniques in conjunction with more modern methods, such as SEM/TEM SED X-ray elemental analysis and NMR studies of protein structure and dynamics, macromolecular interactions, mechanistic enzymology, and computational analyses and modeling, in order to determine the exact nature of the relationship between the nanoparticles and the underlying tissue.

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