

Siemens Competition

Math : Science : Technology

Regional Finalist

Names: David Wu and Xinchu Tian

High School: Troy High School

Mentor: Dr Yi Zhang

Project Title: *Exosomes Derived from Mesenchymal Stromal Cells Promote Axonal growth* (Biochemistry)

Exosomes play a critical role in cell-to-cell communication by transferring proteins and RNAs, including microRNAs (miRNAs). Previous studies found that exosomes from mesenchymal stromal cells (MSCs) promote the regeneration of neurites, but the role of exosomes in axonal growth remains unclear. In this study, we investigate the effects of MSC-derived exosomes on axonal growth of embryonic cortical neurons. We found that MSC-derived exosomes significantly promote axonal growth. Mechanistically, exosome-induced axonal growth is mediated by miRNAs, and attenuation of Argonaute-2 (Ago2), a critical protein for miRNA function, abolished such effects. Furthermore, we found that exosomes derived from miR-17-92 overexpressing-MSCs promote axonal growth as compared to the exosomes derived from control MSCs. Neurons treated with miR-17-92 cluster-containing exosomes had significantly increased expression of individual members of the miRNA 17-92 cluster in cell body and axons, and decreased levels of PTEN, a downstream target for the miR-17-92 cluster. PTEN inhibition increased phosphorylated mTOR and GSK-3 β , suggesting that delivery of the miR-17-92 cluster by MSC-derived exosomes targets the PTEN/mTOR/GSK-3 β pathway. Our data indicate that miRNAs may play a key role in exosome-mediated axonal growth and suggest that exosomes may be a potential neurorestorative therapy for neurological diseases associated with axonal damage.