Eastern Green Neurosurgery Editorial

egneuro,05(01):1-2,2024

Dancing Molecules

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According to the World Health Organization, around 250000-500000 people suffer from acute spinal cord injuries every year worldwide.[1] Major causes of acute spinal cord injury are motor vehicle accident and fall injury. Incidence of acute spinal cord injury is considerably higher in hilly region of our country due to its geographical uniqueness. Besides road traffic accidents, fall from trees and cliffs, diving into shallow river water are the main reasons of acute spinal cord injury with devastating outcome in our context. It has been major challenge for researchers to develop complete cure and restore functional movement after spinal cord injury. [2] Neuroplasticity is the process of remodeling of neuronal signals of brain and spinal cord. Unlike brain neuron tissue, spinal cord neurons have least ability to regenerate after severe injury. [1, 3] Several lab researches have been going on in hope to restore limb functions after spinal cord injury. Neuronal repair, nerve regeneration therapy, like stem cell transplantation, use of bio molecules, 3D bioengineered tissue, gene therapy have been trying for neuronal growth to gain recovery after spinal cord injury.[2] But effective treatment is not yet available. Lab studies have been going on mice for experimental approach for repairing spinal cord injury using stem cells. It has been reported to have success rate of 80% in storing movements in paralyzed mice.[4] olfactory ensheathing cells scaffolds found to have better axonal regeneration capacity that improves astrocytic proliferation at the site of spinal cord injury in animal experiments. [5]

Artificial Intelligence (AI) instructed electrodes on the nerve stimulation device had developed to emit signals to stimulate and sequencing neuronal electrical activity for restoring motor function. AI driven drug discovery can identify compounds that targets specific molecular pathway for neuronal regeneration and repair.[6] Though AI plays crucial role in the development of molecular and biological interventions, neural interfaces and rehabilitation with chronic spinal cord injured patients, no clinically appropriate innovation has been approved by FDA for treating spinal cord injury. The main culprit of least functional recovery after spinal cord injury is scar formation that appears a few days to week after injury and prevents axonal growth away from the injury site. [7, 8] Although some proteins have been investigating for motor functions restoration after spinal cord injury, however due its short half life, effecting land lasting results could not be obtained. Researchers are working on a peptide amphiphile, a protein called Netrin-1 which could work longer on injured neurons and helps to form new neuronal connection and re-growth.[9] It contained two distinct signals. One activates the trans-membrane receptor B1-integrin and another one activates the basic fibroblast growth factor 2 receptor.[10] They intensify the

Date submitted: 21/ 06/2024
Date accepted: 28/06/2024

fibrillary motion in molecules within the scaffold. Dancing molecule, a water-soluble nanofiber gel is one of the latest innovations in repairing neuronal injury and restore paralysis in spinal cord injury. Dancing molecules are nanofibers, formed by thousands of molecules. It has capacity to send signals and built biomaterial scaffolds to guide nerve re-growth, to enhance electrical activity and axonal re-growth.[8] Liquid molecules after injecting into inured site comes together to form tiny fibers like structures called nanofibers that surround the spinal cord. It is believed that molecular motions within the nanofibers could control by changing their chemical structures. Those molecules with much more capacity of movement are more likely to pass signals in neuronal receptors. The main purpose of dancing molecules is to generate collective motions of more than 100000 molecules within nanofibers. It helps to reduce scaring and promotes new blood vessel formation promoting myelin regeneration after injury. It has been stated that dancing molecule therapy is not just useful for treating and regaining motor function in spinal cord injured patient but for those with neurodegenerative diseases.

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