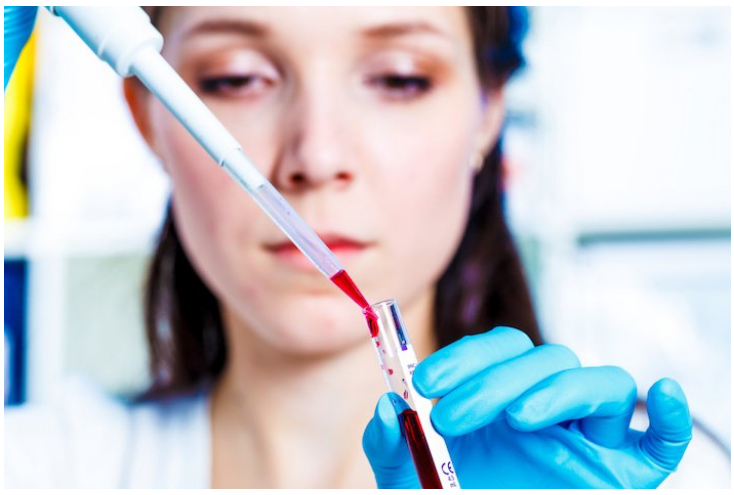
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VIT uses bioengineering approach for neuroregeneration

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This study implies that microvesicles could be considered as a potential candidate for neuroregeneration and as an alternative to stem cell-based approaches where ethics and safety are considered as major concerns



An international team of researchers from Vellore institute of Technology (VIT) in Tamil Nadu, led by Murugan Ramalingam, and Jiangsu University (JU) in China, led by Jiabo Hu, have successfully regenerated a defective sciatic nerve using stem cell extracts.

Peripheral nerve injury is a common and devastating complication which can dramatically affect a patient's life. Nerve regeneration is a complex process. Stem cells promote peripheral nerve regeneration. Stem cells are undifferentiated cells, capable of renewing themselves and give rise to many different types of cells in the body. The various clinical trials involving stem cells support functional recovery after nerve injury, which sheds light on stem cell therapy in near future. However, the mechanism underlying the regeneration strategies of stem cells has not yet been fully understood. It is thought that the stem cells promote tissue regeneration and functional recovery mainly by releasing various paracrine factors.

In a recent study, as reported in the journal of biomaterials and tissue engineering, a team of researchers from the VIT and JU were successfully demonstrated that the stem cell extracts, known as microvesicles (MVs), have nerve tissue regenerative potential and biologically safe and effective in animal models. MVs are a type of extracellular vesicles, having a size range from 100 to 1000 nanometer (nm) in diameter, which are released from the cell membrane. One nm is equal to one-billionth of a meter. A human hair is about 80,000 - 120,000 nm wide.

Stem cell-derived MVs contain various signalling molecules that can trigger the tissue regeneration. MVs play a critical role in cell biological process and are responsible for cell-to-cell communication which is essential for tissue repair and regeneration. MVs are considered as a new therapeutic candidate and are preferred over stem cells for their ethical and safety profiles, said Murugan Ramalingam, senior author of the study.

The team has isolated the MVs from mesenchymal stem cells by ultracentrifugation process. A Sprague-Dawley rat model of sciatic nerve crush injury was established and the MVs were administrated as injection through caudal vein. The neural regenerative potential and efficacy of MVs were investigated using various tests, including the rat footprint test, the hematoxylin and eosin staining of nerve fibers and gastrocnemius muscle fibers. The results showed that the stem cell-derived MVs obviously had an effect on nerve injury repair and inhibited the denervation atrophy of gastrocnemius muscles, said Hu, senior author of the study. This study implied that MVs could be considered as a potential candidate for neuroregeneration and as an alternative to stem cell-based approaches where ethics and safety are considered as major concerns.