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Tissue nanotransfection technique

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Tissue nanotransfection (TNT) is an emerging technique that has been developed under the leadership of Dr Chandra Sen, Dr Gallego-Perez and Dr Lee, three prominent scientists in the field of regenerative medicine. It is a technique that efficiently delivers drugs and cargo at the nanoscale level to the desired cells/tissues through a nano-chip device. It is an advancement in the field of medicine from the conventional methods of gene delivery by tissue bulk electroporation methods. It is a simple and non-invasive technique that is used to reprogram tissues by simply touching the skin which produces an electric current lasting for milliseconds without harming the individual’s body. It consists of two components; first, a nano-chip device that delivers cargo to the tissues, and second, the cargo itself which needs to be delivered. This method uses synthetic DNA/RNA which is nanotransfected through an array of nanochannels for the efficient delivery of cargo to the desired tissue. This DNA/RNA is a combination of reprogramming factors that initiate the reprogramming of the transfected tissue. The TNT chip is placed on the skin and the loading reservoir contains the DNA/RNA (cargo) solution which needs to be delivered. Two electrodes are used in this process, a cathode placed in the well and an anode that is placed intradermally below the chip. The generated electric field is used to deliver the cargo from the reservoir into the contacted tissue through the nanochannel pores. Most of the reprogramming methods use viruses for transfection, but TNT is an effective non-viral method having no chances of adverse effects caused due to viral transfections. This technique has been used to reprogram fibroblasts into neurons by scientists through the delivery of a couple of gene factors (ABM). In another research study, endothelial cells were induced efficiently in an ischaemic mouse by using a couple of plasmids (EFF, Etv2, Fli1 and Foxc2) which brought about new vasculature within 7 days. Hence, the nanotransfection technique can be utilised in tissue therapies including re-growing damaged tissues, healing burns and reducing diabetic complications.

Keywords: Nanotransfection, Reprogramming factor, Cargo delivery, Nano-chip, Nanoscale

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