The Torch
Vol. 2 (12)

De- and recellularisation methodologies in clinical transplantation

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The scarcity of the availability of donor organs for transplantation has led to the development of artificial organs by researchers. To develop organs artificially, a template of the organ or tissue that is intended to replace is required. This template is referred to as a scaffold. Decellularisation technology is being employed in tissue engineering to fabricate such scaffolds. Decellularisation is a process that involves the tissue isolation from a donor when all of its cells are discharged except for the extracellular matrix (ECM) that mimics the properties of the natural tissue; besides, the essential cues for cell preservation and homeostasis are retained in this process. Decellularisation is achieved through the treatment of the donor tissue with chemicals, heat or enzymes that enable the destruction of the cells and the donor’s DNA on the tissue leaving only the acellular ECM scaffold behind. This is followed by the recellularisation process to form a practical organ where the scaffold obtained is seeded with cells. This is accomplished by treatment of the acellular ECM scaffold with stem cells that would be able to differentiate into the target tissue type. Using the decellularised ECM as a scaffold is advantageous since the immunogenic antibodies from the donor tissue are destroyed making it convenient to recellularise the acellular scaffold with cells that are isolated from the host to ensure that the host’s immune system does not reject the organ or the tissue. Decellularisation-recellularisation is found to be a promising tissue engineering approach to solve the problem of organ assembly on demand. A functional organ replacement can be achieved with this methodology to save patients with organ failure.

Keywords: Acellular ECM scaffold, Donor tissue, Decellularisation, Recellularisation, Seeding of stem cells

Citation:
Lerato Jessica Moseme. De- and recellularisation methodologies in clinical transplantation. The Torch. 2021. 2(12). Available from: https://www.styvalley.com/pub/magazines/torch/read/de-and-recellularisation-methodologies-in-clinical-transplantation.