# Licensing hydrogels encased mesenchymal stromal cells.

**Ferntongo Ancey***

Department of Health Science, Curtin University, Perth, Australia

## Abstract

**Gene therapy is a new field of science that uses stem cells as a cell-based therapy to regenerate and restore injured tissue. Stem cells have the ability to self-renew and differentiate into specific lineages, making them a good backup reservoir in the event of tissue damage. They can be autonomously or allogeneically transferred for tissue regeneration in a therapeutic setting; however, allogeneic stem cell transplant can trigger host immunological responses, resulting in a host-versus-transplant reaction. Stem cell encapsulation, a process that encases stem cells in a semi-permeable membrane made of diverse biomaterials, is a possible answer to this problem. Stem cell encapsulation can be achieved using a wide range of natural and synthetic hydrogels, and it has a number of advantages in regenerative medicine, including protection from the protective immune response and mechanical stress, improved cell viability, proliferation, and differentiation, cryopreservation, and controlled and continuous delivery of stem-cell secreted therapeutic agents. We report and evaluate almost all organic and inorganic hydrogels used in stem cell encapsulation in this study, as well as the potential benefits which these materials, alone or in combination, could provide to cell treatment through functional cell encapsulation.**

**Keywords:** Stem cells, Encapsulation, Biomaterials, Hydrogels.

## Introduction

Cell-based therapies have emerged as a promising treatment option for a variety of disorders in recent decades. Various types of stem cells have been employed in laboratory models and clinical trials to regenerate and restore the function of specific injured tissues and organs, and they have been proposed to play a vital role in regenerative medicine. These cells are distinguished by their ability to self-renew and differentiate into particular cell types of all tissues and organ systems of the body in response to micro-environmental conditions, preserving the host's ability to repair harm. Autologous and/or allogeneic implantation of foreign stem cells for tissue regeneration [1].

Because stem cells exhibit the MHC molecules complex receptor and release soluble mediators for welcoming immune cells and permitting this type of reaction, graft-versus-host disease is likely to develop after allogeneic stem cell delivery, and proper measures must be followed. Cell-based therapeutic approaches have been creating new strategies that combine material science and engineering principles with stem cell biology in order to minimise the repercussions of host-versus-transplant reactions, with the use of engineering technologies [2].

Cell immobilization techniques are developed in recent decades to provide cells with a variety of benefits, including supporting structure and a controlled environment. The entrapment of cells in scaffolds and the encapsulation of cells in hydrogels are the two main categories of these approaches. Encapsulation focuses on micro-tuning certain hydrogels to create cell-incorporated, semi-permeable capsules, while scaffolding uses a wide range of materials to provide adequate vehicles for cell seeding [3].

To date, the creation and usage of a variety of organic and inorganic materials has brought a number of benefits in stem cell encapsulation and its application in regenerative medicine, ranging from model systems to cell-based therapeutics. Many researchers have used cell encapsulation as a potential therapeutic treatment in various preclinical and clinical trials, taking into account the aforementioned benefits of cell encapsulation [4].

Even though there are participation in a study references to encapsulated stem cells' potential beneficial role in various disease models, only one Phase I clinical trial investigating their use as a treatment in stroke victims with space-occupying intracerebral haemorrhage was completed three years after it began, with no final results yet published. Stem cells, on the other hand, are unique [5].

## Conclusion

In summary, stem cell encapsulation technology is based on the combined efforts of different disciplines-material science, engineering, cell biology and medicine-each one with distinct challenges to overcome, resulting in significant, but difficult

***Correspondence to:** Ferntongo Ancey, Department of Health Science, Curtin University, Perth, Australia, E-mail: ancey.f@cua.edu

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to achieve, advancements. The development of regenerative medicine and its involvement in modern therapeutic strategies, as well as the possibilities of using more types of stem cells, requires extensive study of the encapsulation capabilities and the plausible development of improved biomaterials that would fulfill these expectations.

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