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ISSN: 2157-7633
Journal of
Stem Cell Research
& Therapy

Opinion Article

A Brief Note on Regenerative Medicine

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DESCRIPTION

Regenerative medicine has been appealing great attention during the past few decades because it is promising in overpowering the limitations of donor shortage and immune problems in direct transplantations. The on-going progress in this field calls for the rapid growth of living materials, which consist of live biological agents and can be designed together with synthetic materials to meet the request demands of regenerative medicine. Here a summary of the state of advancement of living materials that are applied in regenerative medicine is stated.

Regenerative medicine aims at restoring wounded or diseased tissues and organs by uniting basic cell biology with a series of engineering strategies. Regenerative medicine is a capable alternative to transplantation without having to manage with donor source shortage or immune complications, such as heart therapy, bone repairing, muscle regeneration, etc. It thus has changed into an industry in the last few decades along with the development of commercially available therapies. Materials development is an important portion of regenerative medicine since materials are widely involved in almost all aspects of tissue renovation and therapeutic processes including delivery systems, tissue scaffolds, decellularized tissue substitutes, etc.

Design and construction of materials with enhanced structural and physicochemical properties as well as biocompatibility is vital for renewal efficacies. Living material is a hotspot sprung up in current years, which refers to compound materials incorporating biologically derived components, especially living cells. A variety of engineering methods have been exploited in emerging living materials, including genetic engineering, cells encapsulating by or coating with polymers or nanoparticles, fabrication of scaffolds or films with cells rooted, microfluidic-based three-dimensional (3D) tissue or organ models, to list a few . These materials combine the benefits of both living components and non-living components and show potential in regenerative medicine due to their inherent proximity to native tissues. Also, improved bioactivities and highly tunable microstructures communicate those designable materials with controlled and pointed application values in regenerative medicine.

Although living materials could be generally referred to as any kind of biohybrid composites including those encompassing biomolecules, we here focus precisely on those encompassing living cells. Despite the useful and motivating examples of these living materials in regenerative medicine applications, challenges remain in designing and preparing the materials and attaining the ultimate aim of translational usages. With this regard, efforts attention could be focused on the following aspects.

Firstly, because living materials create the combination of living elements and synthetic biomaterial substrate, the interactions between living cells and non-living matrix should be occupied into great consideration. Apart from the basic physiochemical characteristic of the materials, the nano and microstructure, and the innovative functions such as self-healing, self-adaptation, receptiveness, etc., would also affect the intercellular and cell-material connections. The bioimimicking morphology and microstructure would provide a suitable 3D environment for cell contraction, tissue and organoids formation. Based on that, the living materials could be animatedly optimized. The second point focuses on the manufacturing techniques, where the fabrication of the living scaffolds or living models requires precise control of the heterogeneous and biomimicking structures. Also, rheology behaviors at the borders between biocompatible matrix and living elements need to be analysed and measured thoroughly during the fabrication procedure to preserve the vitality of the rooted living cells.

Finally, although paradigms have been made to disclose the potential of living materials, to attain acceptable regenerative medicine applications, the physiological environment, and compound structure should be carefully analyzed. Therefore, appropriate and elaborate distribution of cells in living materials is extremely expected when designing these materials. Although challenges remain, we hope the ongoing achievements in these fields will drive the revolution of both material and medical science as well as associated engineering technologies.

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Received: 28-Jan-2022, Manuscript No. JSCRT-22-15732; **Editor Assigned:** 31-Jan-2022, PreQC No. JSCRT-22-15732 (PQ); **Reviewed:** 14-Feb-2022, QC No. JSCRT-22-15732; **Revised:** 18-Feb-2022, Manuscript No. JSCRT-22-15732 (R); **Published:** 25-Feb-2022, DOI: 10.35248/2157-7633.22.12.517

Citation: Chen Z (2022) A Brief Note on Regenerative Medicine. J Stem Cell Res Ther. 12:517.

CONCLUSION

The last few decades have seen the progress of regenerative medicine since it is expectant for transplantation applications that goal to recover the misplaced or damaged tissues and organs, and disruption through the problems of a supply shortage or immune inflammation. The development of this regime calls for the rise of living materials that refer to synthetic materials combined with biological components, such as living cells. Here first introduced the engineering plans used for the preparation of living materials, including genetic engineering, microfluidics, cell coating, 3D bio printing, among others. After that, the applications listed of these living materials, such as supports for tissue repair, cell therapy, tissue or organ models, etc.