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Latest developments in bio artificial regeneration templates in the field of regenerative medicines

Prakash K. K

Assistant Professor, Department of Biotechnology,
Bapuji Institute of Engineering and Technology,
Davanagere - 577004, Karnataka, India

Abstract - *While many diseases such as bacterial infections and injuries can be cured by drugs and surgery, many others remain incurable. When such incurable diseases become severe, they are often treated by transplantation of tissues and organs from a donor. However, such cases pose the problems of preservation of the organs to be transplanted and dealing with rejection of the transplanted organs. Regenerative medicine was devised as a revolutionary treatment method for solving such problems. It is the process of creating living, functional tissues to repair or replace tissue or organ function lost due to age, disease, damage, or congenital defects. This field holds the promise of regenerating damaged tissues and organs in the body by stimulating previously irreparable organs to heal themselves. One of the main goals of regenerative medicine is to extend and improve people's quality of life by restoring their body back to a normal functional state.*

Key Words: **Cell therapy, transplantation, tissue-engineering, vaccination, cardiomyopathies**

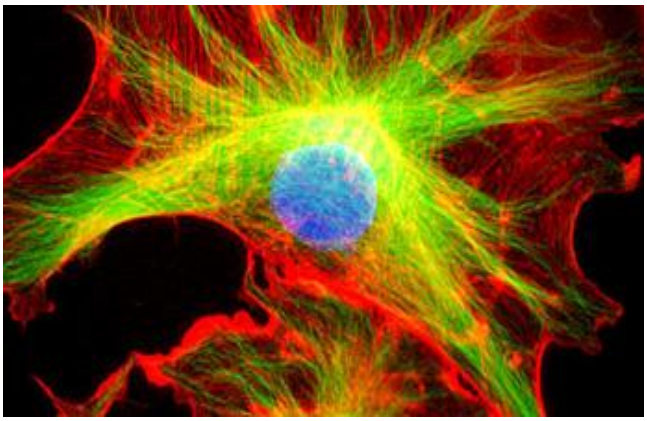
1. INTRODUCTION

Regenerative medicine aims at helping the body to form new functional tissue to replace lost or defective ones. Hopefully, this will help to provide therapeutic treatment for conditions where current therapies are inadequate. Regenerative medicine comprises the use of tissue engineering and stem cell technology. The emerging field of regenerative medicine is unique in its aim to augment, repair, replace or regenerate organs and tissue that have been damaged by disease, injury or even the natural aging process. This rapidly evolving, interdisciplinary field is transforming healthcare by translating fundamental science into a variety of regenerative technologies including biologics, chemical compounds, materials and devices. It differs from other fields of medicine in the array of disciplines it brings together and in its ability to create or harness the body's innate healing capacity. The term "regenerative medicine" was first found in a 1992 article on hospital administration by Leland Kaiser. These newly-isolated cell lines opened the door for the first time in history to the practical manufacture of all the cell types of the human body for use in regenerative therapy.

2. METHODS OF REGENERATIVE MEDICINE:

2.1 Cell therapy:

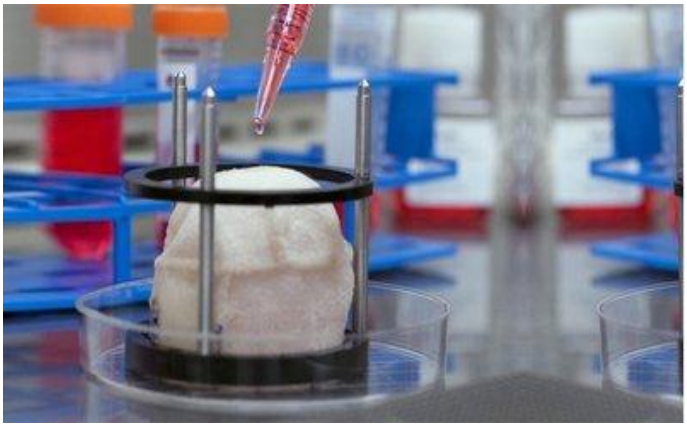
Cell therapy can be defined as a therapy in which cellular material is injected into a patient. There are two divisions of cell therapy. Therapeutic applications include neural stem cell therapy, mesenchymal stem cells (MSCs) therapy and others such as hematopoietic stem cell transplantation. Such therapies have shown promising results in cases of osteogenesis imperfect, Hurler's Syndrome patients, myeloid malignancies and other blood cell diseases. Furthermore, it can also be applied to patients who are severely ill and would not be able to tolerate organ transplantation.



Tissue-engineering:

Concurrent growth in the fields of material bio-engineering and cell biology has led to the possibility to grow tissue-engineered organs.

Bladder:



Various natural and synthetic biomaterials such as gelatin sponge, plastic mold, lyophilized human dura, small intestinal submucosa etc., have been used for urinary bladder regeneration with a wide range of outcomes. An alternative emerging method involves growing a bladder from autologous stem cells seeded on a bladder-shaped scaffold.

Trachea:

In June 2011, Macchiarini et al., successfully implanted an artificial trachea in a 36-year-old patient with late-stage tracheal cancer. Stem cells taken from the patient's hip were treated with growth factors and incubated on a plastic replica of his natural trachea.

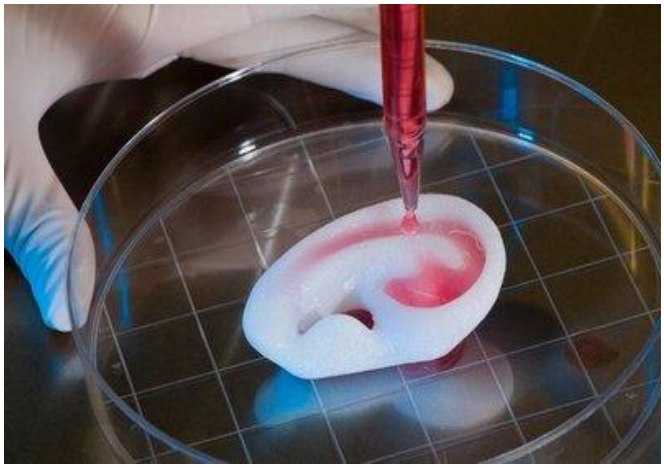
Heart:

Tissue-like cellular patches have been developed by using biomaterials acting as a delivery platform for the cells to improve the efficiency of stem cell therapies. Scaffold-free cell sheet-based tissue-engineering has been introduced by Shimizu et al., for construction of 3D tissue-like structure.

Tissue-engineered skin:

An artificial complete skin (dermis and epidermis) model has been developed for the treatment of severe epithelial injuries

Ear:



In 2006, Wada et al., successfully reconstructed inner ear tympanic cavity and mastoid cavity in rats using a biodegradable collagen scaffold. Outer ear has also been successfully regrown controlling the shape of the ear through shaping of the scaffold structure.

3. RESULTS AND DISCUSIONS

- Novel Methods of Insulin Replacement and Pancreatic Islet Cell Regeneration for Diabetes- Regenerative medicine therapies, such as bone marrow stem cell transplantation or microencapsulated islet cells using novel biomaterials, could increase accessibility by providing a permanent solution and reducing the financial burden caused by the purchase of insulin.

- Autologous Cells for the Regeneration of Heart Muscle After Myocardial Infarction and Cardiomyopathies- Autologous cells, potentially injected directly into damaged regions of the heart or used in regenerative myocardial patches, were emphasized by the panellists due to their advantage of avoiding immune rejection and, hence, costly immunosuppressive regimens.

- Immune System Enhancement by Engineered Immune Cells and Novel Vaccination Strategies for Infectious Disease- The regeneration or enhancement of the immune system by engineered immune cells and novel vaccination strategies could improve an individual's ability to fight infections and to combat new strains of common diseases.

- Regenerative Medicine is used for treatment of Kidney Diseases- In cases of the irreversible damage to the kidney, which is most likely in patients with CRF undergoing long-term dialysis, self-renewal is totally lost. Thus, regenerative medicine for CRF will likely involve the establishment of a functional whole kidney.

4. CONCLUSION

Regenerative medicine has the potential to heal or replace tissues and organs damaged by age, disease, or trauma, as well as to normalize congenital defects. Promising preclinical and clinical data to date support the possibility for treating both chronic diseases and acute insults, and for regenerative medicine to abet maladies occurring across a wide array of organ systems and contexts, including dermal wounds, cardiovascular diseases and traumas, treatments for certain types of cancer. The current therapy of transplantation of intact organs and tissues to treat organ and tissue failures and loss suffers from limited donor supply and often severe immune complications, but these obstacles may potentially be bypassed through the use of regenerative medicine strategies. Research which has developed into this new technology was very critical and challenging. This tough technology needs to be fully developed and harmless before using it on a patient. Scientists are working to better develop so that they can be secure with using regenerative medicine on patients.

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