

## Regenerative medicine technology applied to gastroenterology: Current status and future perspectives

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### INTRODUCTION

In quality of Guest Editor, I am delighted to introduce this special issue of *World Journal of Gastroenterology (WJG)* focusing on regenerative medicine and gastroenterology.

The term “regenerative medicine” (RM) was coined only in 1999 and refers to the field of health sciences which aims to replace, regenerate or bioengineer *ex novo* human cells, tissues, or organs to restore or establish normal function<sup>[1]</sup>. Its main trait is the multidisciplinary approach required to reach its goals. As a corollary, RM investigations are made possible by synergistic contributions of researchers with different backgrounds, namely physicians, veterinarians, cell biologists, extracellular matrix experts, bioengineers, chemists and biochemists, physicists, molecular biologists, biomaterial scientists, mathematicians and statisticians, immunologists, physiologists, geneticists, and others. For this reason, in 2006, the United Nations Educational, Scientific and Cultural Organization defined RM as a super discipline whose contours are still being defined<sup>[2]</sup>. It should be noted that the term “(bio)engineering” is often, yet erroneously, used as synonymous to RM. In fact, the process of regenerating cells, tissues and organs can occur *in vivo* or *ex vivo*, and may require cells, natural or artificial scaffolding materials, growth factors, or combinations of all three elements, whereas the term bioengineering is narrower in scope and strictly defined as manufacturing body parts *ex vivo* by seeding cells on or into a supporting scaffold.

The past decade has been marked by numerous ground-breaking achievements in the field of RM. Researchers have developed sophisticated, cutting-edge technologies to manufacture functional substitutes of relatively simple organs such as vessels, bladders, segments

### Abstract

This special issue of *World Journal of Gastroenterology* has been conceived to illustrate to gastroenterology operators the role that regenerative medicine (RM) will have in the progress of gastrointestinal (GI) medicine. RM is a multidisciplinary field aiming to replace, regenerate or repair diseased tissues or organs. The past decade has been marked by numerous ground-breaking achievements that led experts in the field to manufacture functional substitutes of relatively simple organs. This progress is paving the ground for investigations that aims to the bioengineering and regeneration of more complex organs like livers, pancreas and intestine. In this special issue, the reader will be introduced, hand-in-hand, to explore the field of RM and will be educated on the progress, pitfalls and promise of RM technologies as applied to GI medicine.

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of upper airways and urethras<sup>[1,3]</sup>. These organs were engineered from patients' own cells and successfully implanted to replace diseased or damaged tissue. At the same time, stem cells treatments are being developed and tested in seminal clinical trials for treatment of various diseases<sup>[4-6]</sup>.

This special issue of *WJG* has been conceived to illustrate to gastroenterology operators how RM may impact gastrointestinal (GI) medicine. The manuscript by Carbone *et al*<sup>[7]</sup> stigmatizes the unmet clinical needs in gastroenterology and paves the ground for the following papers which show the fields and clinical settings where RM has the potential to meet those needs. In particular, Domínguez-Bendala *et al*<sup>[8]</sup> from the Diabetes Research Institute of the University of Miami, FL, review the most promising avenues of research aimed at generating a potentially inexhaustible supply of insulin-producing cells for islet regeneration. These avenues include the differentiation of pluripotent and multipotent stem cells of embryonic and adult origin along the beta cell lineage, and the direct reprogramming of non-endocrine tissues into insulin-producing cells. Dufrane *et al*<sup>[9]</sup> from the Pôle de Chirurgie Expérimentale et Transplantation, Université Catholique de Louvain, Brussels, Belgium, complete the session on RM applied to diabetes sciences by drawing state of the art of investigations aiming to produce a bio-artificial pancreas to treat diabetes, with emphasis on islet encapsulation technology and immunoisolation.

Four papers are focused on the bioengineering and regeneration of different segments of the gastrointestinal tract. Koch *et al*<sup>[10]</sup> from the Wake Forest Institute of Regenerative Medicine, Wake Forest University, Winston Salem, United States, report on the most recent developments in the bioengineering of sphincteric units of the GI tract, while Londono *et al*<sup>[11]</sup> from the McGowan Institute for Regenerative Medicine, University of Pittsburgh, Pittsburgh, United States, focus on the esophagus. The group at the Child Health and Great Ormond Street Hospital, University College London, London, lead by Totonelli *et al*<sup>[12]</sup> complements the view on the bioengineering and regeneration of the esophagus by presenting it from the perspective of the pediatric surgeon. This session is completed by a seminal review from the Institute of Advanced Biomedical Engineering and Science, Tokyo Women's Medical University, Tokyo, Japan, lead by one of the pioneers of the field, Takagi *et al*<sup>[13]</sup>. This manuscript<sup>[13]</sup> reports on the most recent progress and clinical translation of one of the most cutting-edge bioengineering technologies, namely cell-sheet, which will certainly fascinate readers. Finally, the special issue is completed by a review paper on the state of the art liver bioengineering by our group at Wake Forest University, Winston Salem, United States<sup>[14]</sup>.

I do believe that readers will enjoy to be introduced, hand-in-hand, to this field, RM, which has the potential to change the way we approach diseases and how we

strategize treatments. I am very grateful to the publisher and the Editor-in-Chief for granting the great opportunity to guest edit the special issue in question. Importantly, the success of this issue has been made possible by the outstanding contribution of the above mentioned authors who are among the biggest names in the field.

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