Introduction

Introduction to the Regenerative Medicine Thematic Issue

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The 20th century was a period of monumental change in medicine, with dramatic advances in our understanding of disease and the development of drugs and devices to treat those maladies. The 21st century is shaping up to be a time of spectacular advancement in regenerative medicine. The goal of regenerative medicine is not the treatment of symptoms; rather, it is to stop disease progression and restore fully functional healthy organs using stem cell-based technologies. All of us will face deterioration or loss of tissues and organs based on trauma, disease, chronic injuries, or aging. The COVID-19 Pandemic has provided an even greater impetus for advancing this field rapidly, as the SARS-CoV-2 virus causes damage to various organ systems (1). Therefore, the development of methods to repair or replace these tissues and organs by means of regenerative medicine may well be the single most important driver for advancing medical care and economic development for decades to come. In terms of economic development: *"The global stem cell market is expected to grow at an incredible CAGR of 25.5% from 2019 to 2025 and reach a market value of USD $586 Billion by 2025"* (Market Watch, April 9, 2020, Stem Cells Market 2020: Size, Growth Opportunities, Trends by Manufacturers, Regions, Applications, and Forecast to 2025).

This thematic issue covers several interesting applications of stem cell therapeutics and regenerative medicine. There are seven minireviews and one original research article in this issue covering topics related to regenerative medicine and cancer (2–4), cardiovascular disease (5), facial rejuvenation (6), interspecies chimeric animals and humanized organs (7), the manufacture of therapeutic cells (9), and improved osteogenesis (9).

In the area of stem cells and Cancer, Yin et al provide an up-to-date review of the role of cancer stem cells in the initiation of tumors, metastasis, resistance to conventional treatment and emerging targeted stem cell-based cancer therapy (2). Tigyi et al discuss the role of Lysophosphatidic acid (LPA) in the regulation of somatic stem cells (SSC) and cancer stem cells (CSC) (3) and Zhang et al describe the role of adipose-derived stem cells, within the tumor microenvironment, on ovarian cancer metastasis and resistance to chemotherapy (4).

Concerning examples of stem cell biology and regenerative medicine, Ly et al discuss the maturation of patient-derived induced pluripotent stem cell-derived atrial specific cardiomyocytes (iPSC-aCMs) (5). The authors discuss the use of metabolic conditioning, extracellular matrix modulation, electrical stimulation, coculture with fibroblasts and endothelial cells, and three-dimensional culture techniques to recapitulate the mature structure and function of cardiomyocytes for study of atrial fibrillation. Crowley et al describes the current status of the use of stem cells in facial rejuvenation and provides a glimpse into the future of precision cosmetology (6).

Garry and Garry discuss the scientific and ethical issues surrounding the production of interspecies chimeric humanized organs that could be used for human transplantation, as a future strategy to overcome the shortage of acceptable organs (7). Kwee and Sung describe bioengineering methods (including biomaterials and bioreactors) to expand autologous and allogenic therapeutic cells, for use in regenerative medicine and immuno-therapeutics (8). The authors further describe the use of microphysiological systems (microfluidic devices, organoids, and/or 3D cell culture systems) to evaluate these cell products under physiologic conditions.

The original article by Kanjilal et al demonstrates the allogenic property of Zinc bound human bone chips or demineralized bone matrix in promoting healing in a Rag2 null rat femoral defect model (9). The study provides support for the use of zinc as an osteogenic adjuvant.

The publication of this exciting Thematic issue coincides with the 8th Annual International Experimental Biology and Medicine Conference (IEBMC), which this year will

be on the subject of Regenerative Medicine. The 2021 IEBMC will for the first time be taking place in the United States. It will occur from October 8-10, 2021 in Memphis TN, and a copy of this Thematic Issue will be provided to all attendees. To learn more about the 2021 IEBMC go to IEBMC.org.

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REFERENCES

1. Afewerky HK. Pathology and pathogenicity of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). *Experimental Biology and Medicine*. 2020;**245**(15):1299–1307. doi:10.1177/1535370220942126
2. Yin W, Wang J, Jiang L, James Kang Y. Cancer and stem cells. *Experimental Biology and Medicine* 2021;**246**(16):1791–1801. doi:10.1177/15353702211005390
3. Tigyi G, Lin K-H, Jang IH, Lee SC. Revisiting the role of lysophosphatidic acid in stem cell biology. *Experimental Biology and Medicine* 2021;**246**(16):1802–1809. doi:10.1177/15353702211019283
4. Zhang W, Torres-Rojas C, Yue, J, Zhu, B-M, Adipose-derived stem cell in ovarian cancer progression, metastasis, and chemoresistance. *Experimental Biology and Medicine*, 2021;**246**(16):1810–1815. doi: 10.1177/15353702211023846
5. Ly OT, Brown GE, Han YD, Darbar D, Khetani SR. Bioengineering approaches to mature induced pluripotent stem cell-derived atrial cardiomyocytes to model atrial fibrillation. *Experimental Biology and Medicine* 2021;**246**(16):1816–1828. doi:10.1177/15353702211009146
6. Crowley JS, Liu A, Dobke M. Regenerative and stem cell-based techniques for facial rejuvenation. *Experimental Biology and Medicine* 2021;**246**(16):1829–1837. doi:10.1177/15353702211020701
7. Garry DJ, Garry MG, Interspecies chimeras as a platform for exogenic organ production and transplantation, *Experimental Biology and Medicine*, 2021;**246**(16):1838–1844. doi: 10.1177/15353702211024948
8. Kwee BJ, Sung KE, Engineering Microenvironments for Manufacturing Therapeutic Cells. *Experimental Biology and Medicine* 2021;**246**(16):1845–1856. doi: 10.1177/15353702211026922
9. Kanjilal D, Grieg C, Culbertson MD, et al. Improved osteogenesis in rat femur segmental defects treated with human allograft and zinc adjuvants. *Experimental Biology and Medicine* 2021;**246**(16):1857–1868. doi:10.1177/15353702211019008