Stem Cells and Therapy: Emerging Approaches
Kursad Turksen, 2020
Cell Biology and Translational Medicine, vol. 7
Springer Nature, Heidelberg, Germany
ISBN: 978-3-030-37844-8
Pages: 153 + VIII; Figures: 30; Color figures: 27; € 145,59

The ten chapters of this volume exploit the potentials of stem cells biology in translational medicine in a very clear way also thanks to nice color illustrations together with tricks and suggestions useful to get reproducible results.

The hype and hope of stem cells therapies have been one of the main topics in biology and medicine during the last two decades; this book is the right tool to face them while looking at the emerging innovative therapeutic approaches. The readers will surely appreciate the great efforts of Prof. Kursad Turksen to "cover several crucial aspects of tissue and organ regeneration and restoration of function in clinical settings".

The subject of the introductory chapter "application of the iPSC to modeling of respiratory diseases" by Ben Calvert and Amy Ryan is very actual and demanded because it is addressed to the recovery of the lung epithelia affected by the COVID-19 disease: a still (because recent in this specific case) unmet clinical need.

Also, novel therapeutic strategies are needed to treat lung diseases which are constantly growing due to the increasing incidence of the elderly population. The differentiation of autologous iPSC towards lung cells lineages have the potential to greatly widen current treatments (which are just symptomatic reliefs for some diseases) because we are now able to model lung diseases to understand their pathogenesis.

The readers will acquire the most up-to-date knowledge on the iPSC ability to regenerate tissues from the induction of the pluripotency state to the specification of primordial lung progenitors till the tracheobronchial and alveolar differentiation.

In the second chapter, Hatice Burcu Şişli and colleagues explore the gene editing world with an interesting review about the Zinc Finger Nucleases (ZFNs), the Transcription Activator-Like Effector Nucleases (TALENs) and the revolutionary CRISP-Cas-9 system. It is needless to say that gene editing will play a great role in the development of stem cells technologies for the advancements of several therapeutic applications.

The capacity of the vascular walls to provide stem cells able to differentiate into endothelial cells is presented by Roberto Tamma and colleagues. This contribution will be highly appreciated by the general readers because covers topics like the discovery of the vascular progenitor cells in the bone marrow and the niche of the endothelial progenitor stem cells.

Stefanie Lazow and Dario Fauza guide the reader through one of the most advanced stem cell therapy named TRASCET (Transamniotic Stem Cell Therapy), considered an alternative therapeutic approach to treat congenital diseases at the prenatal level. It is known that amniotic fluid-derived mesenchymal stem cells (afMSCs) are physiologically able to repair fetal tissue. Recent studies on rodents showed that the increased delivery number of these cells is effective in the treatment of neural tube defects and gastroschisis. Based on these evidence, the authors are studying possible alternative cell sources (placental-derived mesenchymal SC, pMSCs) and the still unknown mechanisms accounting for both afMSCs and pMSCs homing. As stressed in this article, congenital birth defects are reported in 3-4% of live births and thus there is a high expectation to treat them through a novel prenatally, minimally invasive and ethically unobjectionable, option.

Another glance at the future of stem cells therapies is the use of stem cells derivatives like stem cells extracts, gene edited stem cells and exosomes as vehicle for local drug delivery as done by Hoda Elkhenany and colleagues to treat one of the most common type of cancer, the hepatocellular carcinoma (HCC). In this chapter, the illustration of the molecular pathogenesis of HCC and the description of the clonal or stochastic model to account for the origin of cancer stem cells (as pre-needed conceptual tools) is followed by a comprehensive round-up on different stem cells types use to target HCC: MSC, bone marrow-derived MSC, adipose-derived MSC, amnion-derived MSC and umbilical cord-derived MSC. The sections devoted to the use of engineered MSC and exosomes are quite interesting too: first, the insertion of tumor necrosis factor-related apoptosis-ligand (TRAIL) into bone marrow and adipose-MSCs to induce apoptosis and necrosis in different types of cancer cells (lung, glioblastoma, breast, etc.) is here presented. Second, exosomes are here shown as possible "tools to be used" for HCC treatment when made by engineered cells (like adipose-derived MSCs). These vesicles are two-faced cellular particles able to promote tumorigenesis when secreted by tumor cells. Several colored figures, tables and a rich bibliography enrich the chapter.

There are many variables playing a role in determining the success of Cell-based Therapy (CT) for regenerative medicine, ranging from the needle size to the selected stem cells to transplant. They can all affect stem cells homing and functionality, thus lowering the clinical outcomes of the technique and the therapeutic benefits. There is, however, some good news: these variables are amenable to significant improvements (thanks to injectable cell/tissue/gene-based products) as the detailed chapter written by Ali Golchin and colleagues clearly shows. Here there is also a long table full of information (*i.e.* commercial name, product description, dosage administration and few minor details) about the injectable cell/tissue/gene-based products with marketing authorization. The reader can "enjoy" the very long table after going through the illustration of key points (*i.e.*, cell tracking and homing) in designing injectable CT and injection methods.

The fascinating world of parthenogenetic embryonic stem cells (ParthESC) is highlighted by looking at one of the many intriguing properties of these cells: the formation of 3D spheroid colonies expressing Rho and Hippo signaling pathways. Making use of these model, Georgia Pennarossa and colleagues advance our understanding of the molecular bases of stem cells pluripotency and plasticity.

The chapter written by Pravin Shende and Drashti Desai is devoted to the therapeutic applications of metal nanomaterials for the treatment of several diseases of the CNS (anxiety, depression, learning and memory, alcohol dependence, Alzheimer and Parkinson diseases), endocrine (diabetes, obesity), intestinal, respiratory and cardiovascular disorders while the last chapter covers aspects related with the impact of the low frequency of the electromagnetic field on humans. This is one of the current hot topics because several papers, over the years, reported controversial results on the effects of low-frequency electromagnetic fields (EMF) on our DNA. This last review ends by saying that, nowadays, no firm conclusions can be drawn about the effect of EMF on genetic material.

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Received for publication: 3 September 2020. Accepted for publication: 10 September 2020.

European Journal of Histochemistry 2020; 64:3178
doi:10.4081/ejh.2020.3178