

Regenerating the heart
Stem cells and the cardiovascular system

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A book dealing with the heart regeneration achieved thanks to cell therapies sounds like an immense challenge, considering both how the field rapidly progresses and the necessary interdisciplinarity to exhaustively cover all of the multifaceted aspects of the subject. The great modesty that the two editors show up in the *Introduction* section while writing that they declined the offer to write a book devoted to the heart regeneration is therefore something highly appreciable. Furthermore, the reader get an empathetic filling of great sympathy with the two editors (an electrophysiologist and a mechanical engineer) when he is told that they accepted to edit a book devoted to the very same subject. And they did so with the idea that this could be a great chance for them to learn from the papers of the outstanding experts called to contribute the most advanced results and telling us the strategies to fulfill the goal of heart regeneration. Well done, this is a great sign of scientific seriousness and immediately the reader can appreciate the result: the book, a great book, which I hope you will get on your desk. Divided in four sections, it clearly follows a didactic and understandable ordered exposition beginning with the regeneration of the mechanical functions followed by the regeneration of the electrical functions thanks to stem cells therapies. The third section is dealing with the regeneration of the various cardiac tissue types while the fourth is devoted to the efficacy's evaluation of the *in vivo* stem cell therapies. The didactic exposi-

tion of the twenty-six chapters is such that each of the sections cover either the historical, the present-day and the future avenues of the treated themes so that the reader is accompanied throughout a full knowledge of the field, from its very beginning to the next acquisitions to fully restore the functionality of the highly complex structural and cellular heart's composition. Thus the journey starts with the induction of embryonic stem cells toward the cardiomyocytes differentiation and the evaluations of the advantages (and limitations) and of the long-terms prospects of such therapies. The reader will be captivated, I am pretty sure, by the chapter devoted to the intriguing phenomenon of the mesenchymal stem cells homing (cytokines, chemokines, a word of molecules dancing around), they survival and the never ended debate on their true differentiation, and integration, into cardiomyocytes versus the paracrine effects they can exercise on the surrounding tissues. Bone marrow is one of the stem cells source and the methods to differentiate myocytes and use them in cell therapies are well documented, as it is a review of the multiple possible sources for cardiac stem cells, not forgetting the evidence for the existence of resident cardiac stem cells. Skeletal muscle stem cells do contract (even though they are not cardiogenic), and thus they have been used in early attempts for cellular myoplasty. This historical opportunity is reviewed together with the (opposite) foreseeable chance to use the cellular products of one of the major breakthrough in stem cell biology, the induction of pluripotency. One of the leading experts, Tanja Dominko with her colleagues, is presenting the *in vitro* achievements springing out from such a Columbus egg's idea (likely Shinya Yamanaka will become a Nobel laureate!), while other chapters are dealing with the *in vivo* translational medicine opportunities offered by the use of the induced pluripotent stem cells for myocardial infarction repair and cardiac regenera-

tion. The electrical networks are complex as the mechanical ones and the reader in the second section will face the same didactic exposition route as in the first section: when dealing with the treatment of arrhythmias (both bradyarrhythmias and tachyarrhythmias), he is told of the possibilities of tissue regeneration as well as of the advantages and limitations of the gene and cellular therapies. Regenerating the complex cardiac tissues is the content of the third section which explain blood vessels and heart valves regeneration in addition to tissue engineering strategies for cardiac regeneration. Obviously, considering both the morbidity and the mortality of the valvular heart diseases, the chapter devoted to the valves is attracting the reader and for his satisfaction we are told of the very promising capabilities we already reached to biomodeling neo-heart valve tissues with thromboresistant surface thanks to the culture of autologous harvested cells on three dimensional backbones. The final part of the book is devoted to the *technical* issues embedded with stem cell therapies (cell delivery, tracking stem cells *in vivo* and the assessment of the mechanical function) and the reader at this point experiences a sense of gratitude for all those (scientists, decision makers, philanthropists, etc.) who along decades were able to provide us with an educational trend capable of rendering a common finding in the public locations the presence of defibrillators.

Thanks to their efforts even the laypeople is today conscious of the heart debilitating diseases, of how much he can do to prevent diseases thanks to a healthy life style. This book is part of this educational trend and the series editor Kursad Turksen (senior scientist, regenerative medicine, Ottawa Hospital Research Institute) deserves a praise.

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