Bioprinting in Regenerative Medicine
Kursad Turksen (ed.), 2015
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Prof. Turksen is a very well known scientist in the stem cell biology field and he is also internationally known for his fundamental studies on claudin-6. In addition to his research activity, he is editor for the *Stem Cell Biology and Regenerative Medicine* series (Humana Press) and editor-in-chief of *Stem Cell Reviews and Reports*.

The technique presented in this book has the potential to revolutionize the translational medicine applications of the coming years due to the more affordable costs related to 3D bioprinting.

Bioprinting technologies entail several different aspects, ranging from biomedical to legal and regulatory aspects, nicely presented in the six chapters of this volume strongly recommended for both beginners and experienced colleagues. All the topics have been carefully selected to stress the important role that bioprinting is nowadays playing in the regenerative medicine field. In particular, this technique is becoming increasingly important for the printing of organs in 3D to satisfy (in the near future) unmet medical needs. Prof. Turksen rightly speaks about the *ultimate goal of restoring function of damaged tissues and organs* in his introduction.

Chapter one deals with some basic principles related to bioinks. It is an impressive chapter written by Stuart K. Williams and James B. Hoying covering this whole subject with an amazing body of literature consisting of 367 references. Gel, solutions, additives, chemicals, photoinitiators and obviously cells are tested as well as related troubleshooting are clearly and wisely indicated.

Chapter two is a multi-authored paper leaded by Vivian K. Lee and devoted to stem cell engineering thanks to 3D bioprinting assisted by 3D imaging. Advantages and disadvantages of each of the bioprinting and imaging techniques currently in use are here dissected and compared by means of tables and quite useful colored graphical abstracts suggesting the integration of macro- and micro-printing for several tissue engineering applications. The exciting opportunity to do bioprinting with living cells is the topic of chapter three written by Burce Ozler, Can Kucukgul and Bahattin Koc. The authors compare several procedures like cell-sheet technology, inkjet- and self-assembly based bioprinting with the extrusion-based bioprinting (*i.e.*, the forced continuous filaments of materials through a nozzle). By reading this chapter, it is easy to understand which is the best procedure to use for our own purpose, without losing time.

Chapter four is dealing with hydrogels used for cell encapsulation, a crucial step of the whole procedure of bioprinting. Seyed Shariati and collaborators list several biophysical properties of biogels that need to be critically evaluated by bioprinters: viscosity, gelation time, water content, swelling, degradation and structural stability (in other terms, mechanical properties) are dissected and clearly illustrated to be useful also for the beginners facing this topic for the first time.

Chapter five is presented by Xiaofeng Cui and illustrates some of the current 3-D bioprinting approaches in regenerative medicine like microvasculature, muscle, cartilage, bone printings.

The final chapter written by Dileep Monie and Sujata Bhatia is devoted to the hottest bioprinting technology that is the organs-on-chips for rapid drug development and personalized medicine. A very useful historical perspective on the clinical need for organs-on-chips in presented here, thus letting the reader to better understand the current challenges of this bioprinting procedure. A useful section is devoted to regulatory and future directions of bioprinting design and fabrication.

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