Cardiovascular Regenerative Biology

Disease of the cardiovascular system accounts for nearly one million deaths per year in the USA alone, and aging demographics mean that this problem will only become more severe. Tissue engineering/regenerative medicine approaches that can reconstruct functional healthy cardiovascular structures would obviously have a major impact on health care delivery. An improved understanding of cardiovascular cell-cell and cell-matrix interactions, stem cell biology, the influence of the microenvironment on cell fate, and integration of regeneration with the principals of developmental biology have collectively resulted in more clinically applicable approaches. This special edition of *Cells Tissues Organs* describes current concepts and approaches that have the potential to be critical components of the next generation of therapy to create and/or repair blood vessels and heart tissue.

There are four sections in this double issue: Cell Sources for Cardiovascular Tissue, Niche Scaffolds, Blood Vessels and Vascular Networks, and Engineered Heart Tissue. The section on cell sources includes manuscripts describing state-of-the-art methods for cardiovascular cell purification and derivation, discussing potential cell sources for tissue engineering, including the use of pluripotent human stem cells. Contributions to this edition by Wang et al. (pp. 5–14), Sundaram et al. (pp. 15–25), Amos et al. (pp. 26–40), and Chaudhury et al. (pp. 41–47) describe potential cell sources for regenerative medicine applications, the methods of cell generation and purification, and clinical applications. Manuscripts by Fernandes

et al. (pp. 48–59), Naito et al. (pp. 60–72), Majesky et al. (pp. 73–81), and Peter et al. (pp. 82–93) provide an excellent overview of the importance of the microenvironmental niche for cell fate. These manuscripts also contribute to our understanding of the importance of the innate immune response to cell fate after implantation.

The clinical applications related to the formation of blood vessels and vascular networks, and insights gained from models thereof, by Chappell et al. (pp. 94–107), Peng et al. (pp. 108–121), Sacharidou et al. (pp. 122–143), and Peck et al. (pp. 144–158) provide an excellent overview of advances in blood vessel engineering and the concepts that drive their optimal design. These manuscripts provide a clear sense of optimism that a functional vascular graft will be developed to replace or complement autologous tissues in patients with acquired or congenital vascular disease. Finally, contributions by Wainwright et al. (pp. 159–170) and Freytes et al. (pp. 171–182) provide a look at next generation myocardial replacement materials and methods for creating functional myocardium. In all, this issue provides a resource of current findings in cardiovascular regenerative medicine. Although significant challenges remain, optimism is high and the future will be very exciting.

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