Aging Stem Cells and Regenerative Biomedicine: Concepts, Opportunities and Technological Advances

Special Issue: “Stem Cell Aging and Regenerative Medicine”

Editorial by

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Within our bodies, growth, remodeling and regeneration greatly rely on the appropriate action of stem cells. There is a large variety of different types of stem cells present in higher organisms, and indeed, these cells do exhibit abilities to both replenish themselves as well as to bring forth progeny, which is engaged in tissue und organ repair accordingly. In contrast to model systems such as the salamander, which display unprecedented regenerative capabilities (Roy and Gatien, this issue), in higher organisms that are subject to aging, the respective regenerative capacity of innate stem cells appears to be, by and large, limited. More than that, it is commonly known that with advancing age, the body's performance to restore its proper function after insults of injury and disease may decline dramatically. Needless to say that this poses the pivotal question, whether basic properties of stem cells are lagging and eventually dying away due to the ravages of aging (Zenzmaier et al.; Wahner et al.; Zouboulis et al.; Sim et al.; Nalapareddy et al.; all this issue).

As most colleagues in the field agree with, the paramount long-term goal of aging research is not to prolong life at any price, but to help people growing old in dignity and in good health. To achieve progress in that, tissue engineering is just one of the emerging techniques in biomedicine (Atala et al, this issue). There are high expectations that stem cell technology in combination with bioengineering advances will provide solutions required to eventually cure various diseases. This in mind, many laboratories and institutions embarked on work on stem cells. Since it is not clear to date whether stem cells of embryonic origin can be applied to yield secure cellular

therapies (Cedar and Minger, this issue), stem cells that are innate within adult individuals, are thought to be helpful to overcome such pitfalls (Ratajczak et al.; Lepperdinger et al.; both this issue). Whether tissue-specific stem cells from adult organisms of advanced age, which in addition may also suffer from age-associated pathologies, can be successfully propagated and subsequently used for cell-based therapies, is but unclear as well.

The special issue in hand also features specific attempts, which are designed to pioneer research in regenerative medicine. In most, if not all preclinical studies that have been tailored to explore cell-based therapies, experimental animals are in their prime age. In a clinical setting though, the elderly patient clearly represents the majority. In terms of translating our current knowledge from bench to bedside, the most challenging future research tasks will be to adopt these emerging technologies to direct and support regenerative and healing processes in the elderly patient (Brehm et al., this issue). It is greatly believed that only this type of exciting research will yield insights of how to employ stem cells in elderly human beings to extend their health span.

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