

Introduction to the Special Issue on Stem Cells and Regenerative Medicine

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The special issue “Stem Cells and Regenerative Medicine” was enthusiastically released by the Editorial Board of *European Journal of Histochemistry* on 2020. The fusion of these two topics reflected the hope and potential that advances in regenerative medicine would be the promising outcomes of the basic and translational research collected in this special issue. This issue is dedicated to identifying priorities in stem cell biology and capturing the cutting-edge thinking in stem-cell based regenerative medicine.

Stem cells are identified as undifferentiated cells capable of self-renewal, differentiation into different types of cells, proliferation and regeneration of tissues. Since 1960s, following the first identification of hematopoietic stem cells (HSCs) by McCulloch and Till,¹ mesenchymal stem cells (MSCs) were subsequently isolated by Friedenstein and his colleagues from bone marrow in 1976.² In 1981, Lotfinegad and colleagues³ isolated the first embryonic stem cells (ESCs) from the inner cell mass (ICM) of mouse and since then, ESCs have been isolated from other mammals such as sheep,⁴ rabbits,⁵ cattle⁶ and human.⁷ About 25 years later, the discovery of induced pluripotent stem cells (iPSCs) by Shinya Yamanaka⁸ was heralded as a major breakthrough of the decade in stem cell research. Along with new fundamental discoveries in stem cells, the field of stem cell biology has sparked scientists' interest to the point that stem cells, capable of growing indefinitely *in vitro* and maintaining the capacity of differentiation, could work as “model” organisms to study organogenesis and the therapeutic potential of transformative regeneration.

Promising results from preclinical studies and clinical trials deepen our appreciation of application of stem cells in regenerative medicine. Stem cell-based therapy applies the understanding of stem cell development, differentiation, and maintenance to generate new, healthy tissue for diseases

needing transplant or replacement of damaged tissue, such as heart failure,⁹ cirrhosis,¹⁰ diabetes mellitus,¹¹ leukemia,¹² Crohn's disease,¹³ neurodegenerative disease¹⁴ and so on. However, widespread implementation of stem cells in regenerative therapeutics remains a big challenge. Either ESCs or iPSCs has a risk of tumor formation after injection into the host.¹⁵ On the other hand, genetic and epigenetic instabilities of stem cells during reprogramming may cause cellular impairment, organismal aging and even malignant outgrowth¹⁶ and thus set severe limitations in clinical applications. Finally, stem cell-based therapy is also ethnically challenging. We should consider the integration of existing ethical frameworks with new ethical implications to move forward this field.

Aside from casting a spotlight on stem cell biology and its regenerative application, the launch of this special issue will also explore different immunohistochemical methods used in characterizations of stem cells. This field is clearly of particular interest to *European Journal of Histochemistry*. All the stem cell-related papers published in the journal will be collected together in this issue, providing a one-stop shop for stem cell researchers to find the ideal approaches.

Stem cell in regenerative medicine is an area of biomedical sciences where several exciting discoveries may be disseminated prior to full peer review and publication. We hope that this timely collections of papers from excellent scientific researchers may contribute greatly to this field, through the introduction of stem cell history and recognition of the common challenges that lay ahead in a well-balanced manner. Clearly, the field has a responsibility to communicate openly and fairly about advances, as well as failures, so that the audience could benefit maximally from *European Journal of Histochemistry*.

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