

Special issue for stem cell metabolism: be quiet, grow, and differentiate

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Stem cell research is one of the fastest growing fields of the natural sciences. Tremendous hopes are based on stem cell-based technologies to understand mechanisms of disease and to utilize stem cells or their derivatives to eventually regenerate impaired tissue or organ function. Thus, expectations are high that the stem cell field will proceed to contribute to medical advancement. However, basic mechanisms of stem cell behavior such as cellular and molecular control of cell proliferation and fate potency need to be understood for successful future therapeutic approaches. Substantial progress has been made over the last decades to identify key regulators of stem cell potency, proliferative activity, and differentiation capacity.

Cellular metabolism, which was intensely studied in the 1950–1980s but has been neglected over the last 15 years, is emerging as a pivotal player in regulating stem cell behavior. With the advent of new technologies such as mass spectrometry-based metabolomics and metabolic tracer studies, cellular metabolism got back into the focus of cell and stem cell biology. Impressive progress has been made over the last years. In this special issue a few of the many aspects how cell metabolism regulates cellular behavior are discussed. Topics such as how metabolism influences behavior of neural stem cells, immature neurons, endothelial cells, metabolic tissues (such as liver, adipocytes and pancreas), and hematopoietic stem cells, as well as technical approaches to study metabolism are covered.

In the future, substantial advance is foreseeable in our understanding of the metabolic switches that occur with changes of cell fate and behavior. Furthermore, it will be exciting to probe how key cellular behaviors such as quiescence, proliferation, or differentiation may have common metabolic signatures between somatic tissues. Finally, it may turn out that cellular metabolism represents a major hub where a number of signaling pathways converge to regulate cellular behavior. This special issue covers a selection of the diverse and fascinating functions that metabolism exerts on cells and tissues.

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