

HUMAN GENETICS & GENETIC DISEASES

and

MOLECULAR MEDICINE & DIAGNOSTICS

Impact of stem cell-derived extracellular vesicles on cell fate decisions: Implications in tissue regeneration

Sylvia Bobis-Wozowicz
Jagiellonian University, Poland

Increasing number of individuals affected by various civilization diseases related to the cardiovascular and neurological systems among others, constitutes a challenging socio-economical problem in the developed countries. Thus, there is a considerable need to improve or develop treatment strategies to replace or regenerate the damaged or dysfunctional tissue. With this respect, stem cell-based therapies hold great promise for organ regeneration. Importantly, it has been reported that not only the stem cell engraftment and differentiation, but also their paracrine activity plays a role in reparative process. Among paracrine factors, extracellular vesicles (EVs), which are small circular structures composed of cellular membrane and cytosolic cargo, seem to be particularly important. By transferring their bioactive content, mainly in the form of small RNAs, proteins and lipids, EVs may influence fate decisions of target cells, including tissue residing progenitors and stem cells. Studies conducted by our research group indicate that EVs released by different populations of stem cells, including mesenchymal stem cells (MSCs) and induced pluripotent stem cells (iPSCs), exert strong positive effects on recipient cells in vitro and in vivo. We have shown that iPS-EVs transfer exerted pro-proliferative and cytoprotective effects on the recipient primary human heart cells and enhanced their cardiac and endothelial differentiation potential. Similarly, MSC-derived EVs harvested in certain xeno-free media increased cardiomyogenic ability and endothelial functions of target cells. Furthermore, injection of mouse iPS-derived EVs to the infarcted mouse hearts, led to the improved left ventricular function and superior perfusion in the infarct zone. Our results open new avenues for developing novel stem cell-based therapies by employing their acellular, thus safer derivatives, which may be successfully utilized for tissue repair.

Biography

Sylvia Bobis-Wozowicz has her expertise in stem cell biology, genome editing and stem cells applications in pre-clinical models of organ regeneration. She uses native and genetically modified stem cells from various sources (bone marrow, umbilical cord, adipose tissue, as well as induced pluripotent stem cells) to develop novel treatment options for tissue damage repair, particularly in the ischemic heart diseases. Her recent work utilizing stem cells-derived extracellular vesicles (EVs) as acellular mediators of cell fate decisions showed considerable role of these paracrine factors in enhancing proliferation, differentiation, metabolism and survival of target cells. Moreover, she has demonstrated that properties of mesenchymal stem cells and their EVs can be greatly affected by the type of xeno-free media used for cell culture. Such observation has a great impact on clinical application of both, cells and EVs, where specific phenotype and function of target cells is expected.

sylvia.bobis@uj.edu.pl

Notes: