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Induced pluripotency and neural differentiation of human cord blood derived stem cells: The role of epigenetic stimulation

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Nowadays human derived neural stem cells are considered as an important approach for the cell based therapy in various still incurable diseases or traumatic injuries of CNS. Stem cells for personalized medicine can be obtained either by direct isolation of somatic tissues specific stem cells or by generation of induced Pluripotent Stem (iPS) cells from any tissue of the body. Human cord blood stem cells have the advantage of being in special ontogenic position of somatic, but foetus derived, thus still immature stem cells. In addition to this biological "superiority" they are easy to obtain and ethically non-controversial, thus attractive for regenerative medicine applications. A decade ago we have demonstrated that human umbilical cord blood derived stem cells cultured *in vitro* acquire neural progenitor-like properties by expressing neuronal and glial specific markers. Further we have established the first clonogenic, non-transformed Human Umbilical Cord Blood Neural Stem Cell (HUCB-NSC) line. Our recent experiments have shown that HUCB-NSC can be transformed to iPS cells using viral-free, safe methods of reprogramming. Recombinant penetrating proteins as well as the "MiniCircle" DNA non-integrating plasmids were applied. Additional epigenetic control over stem cell reprogramming and fate decisions was exerted by manipulation of oxygen level conditions and application of small molecules. Lowered oxygen (5%) tension as well as treatment with epigenetic factors TSA and RG-108 (histon deacetylase and DNA methyltransferase inhibitors respectively) have stimulated expression of the defined "pluripotency markers". Changes in epigenetic and molecular signature of HUCB-NSC during reprogramming and neuronal differentiation have been monitored and their effects will be discussed in this presentation. Several issues in basic and experimental research must be urgently resolved before stem cell based therapies can be tested in patients, but our results suggest that cord blood derived neural stem cells may be considered as strong candidates for such applications. Sponsored by grant from Polish Ministry of Scientific Research and Higher Education No 5978/B/PO1/2010/38.

Biography

Professor Buzanska completed her PhD in 1990 from Warsaw University, Department of Biology and habilitation qualification (DSc) in 2007 in medical sciences from Mossakowski Medical Research Centre, Polish Academy of Sciences. For 15 years she was working in Department of Biology, Warsaw University, from 1996 in NeuroRepair Department, MMRC PAS. Presently she holds a professor position in MMRC PAS and is the Head of Stem Cell Bioengineering Laboratory. Her sabbaticals included University of Aberdeen, State University of NY (SUNNY) and European Commission, Joint Research Centre. In the latter she was a visiting senior scientists for 4 years (between 2005 and 2009). Present scientific interests include mainly somatic stem cell bioengineering and neural tissue engineering. She has published more than 60 original peer review articles in reputed journals and a few book chapters. She is an internationally recognized reviewer and the member of Scientific and Executive Boards for International Societies and Journals.