

3rd International Conference on Tissue Science & Regenerative Medicine

September 24-26, 2014 Valencia Convention Centre, Spain

Shaping the microenvironment for physiological cultivation of human adult stem cells

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Although our knowledge about the *in vivo* microenvironment of stem cells (the biological niche) is steadily increasing, “standard” cell cultivation is still performed under not physiologically relevant conditions. Usually cells are cultivated under ambient oxygen conditions in static 2D cultures on plastic surfaces. Since cellular responses are highly dependent on the complex interplay between cells and their microenvironment, it is important to develop more physiologically relevant cultivation systems for *in vitro* cellular studies. For specialized stem cell cultivation already several bioreactor systems are available. These systems have the advantage that they provide medium perfusion which enables better oxygen and pH control as well as continuous nutrient supply and waste removal. Furthermore dynamic cultivation allows mechanical stimulation, which is an important cue for stem cell differentiation. A great variety of specialized bioreactors ranging from miniaturized to large-scale systems on 2D surfaces and within 3D tissue-like matrices with and without integrated biosensors has been developed.

The lecture will provide an insight into dynamic cultivation of human adult stem cells in specialized bioreactor systems. A general introduction will be focused on the unique characteristics of dynamic stem cell cultivation and the differences to standard cultivation procedures. The potential and benefits of dynamic cultivation will be highlighted, but also risks, potential pitfalls and limitations of will be discussed. Different dynamic systems for stem cells expansion and differentiation will be introduced. The presented bioreactor types will range from miniaturized microfluidic set ups to clinical scale reactors and include 2D cultures as well as 3D tissue-like structures.

Biography

Cornelia Kasper completed her PhD in 1998 from Leibniz University of Hannover (Germany) and her habilitation in 2007 at the Institute for Technical Chemistry at the Leibniz University of Hannover. She was appointed as full University Professor for “Biopharmaceutical Production and Technology” at University of Natural Resources and Life Science (BOKU) in Vienna (Austria) at the Department of Biotechnology. She has published more than 80 papers in reputed journals and several book chapters and is editor within the series “Advances in Biochemical Engineering and Biotechnology” (Springer) of several volumes covering actual areas in Tissue Engineering and Stem Cell Research. She is also reviewer for many distinguished journal within the field of biotechnology/bioprocess and bioreactor design and enabling technologies for stem cell cultivation.

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