STEM CELLS TRANSLATIONAL MEDICINE®

PREVIEWS

Previews highlight research articles published in the current issue of STEM CELLS, putting the results in context for readers.

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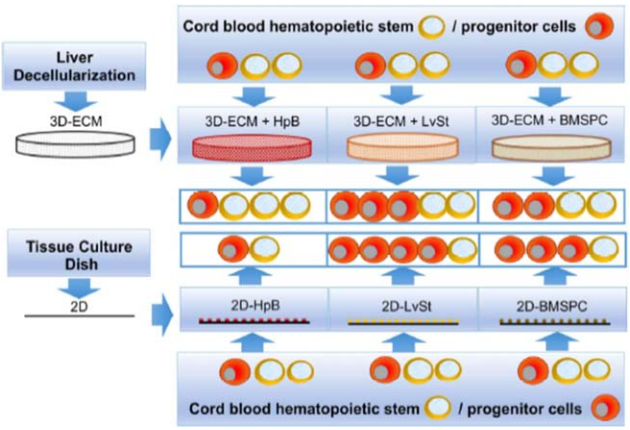
Cultivation of stem cells under traditional adherent two-dimensional (2D) conditions does not faithfully mimic the three-dimensional (3D) environment of tissue-specific stem cell niches [1]. Therefore, we should not expect stem cells grown in vitro in a 2D setting to behave appropriately given the lack of the spatial contacts and signals usually afforded to them by their in vivo 3D niche. Transiting from simple 2D to complex 3D culture systems may provide better opportunities to fully understand the mechanisms that control stem cells and also to generate complex stem cell-derived tissues for transplantation and modeling [2]. The authors of this month's first Featured Article (Mokhtari et al.) looked to the third dimension as a strategy to preserve primitive hematopoietic cell number during the in vitro expansion of cord blood (CB) stem cells. In a Related Publication, Pringle et al. describe how the culture of stem cells derived from the salivary gland (SG) in 3D organoid cultures may provide a means to counteract cancer-treatment side effects.

The therapeutic applications of patient-derived stem cells such as adipose stem cells (ASCs) or bone marrow mesenchymal stem cells include the repair of muscle damage or injury. While not generally life-threatening, injuries to the circular anal/urinal sphincter muscles can significantly affect patient's quality of life and stem cell-based treatments are now being explored given the current lack of effective treatment approaches [3]. However, stem cells derived from patients of varying ages can present with age-related defects in functionality, an important consideration for the widespread clinical application of stem cell therapies [4]. Our second Featured Article from Kuismanen et al. explores the possibility of treating anal sphincter defects and associated anal incontinence (AI) with injections of human ASCs. In a Related Article, Shan et al. study the aging process of ASCs in the hope of discovering a means to enhance their regenerative potential and understand alterations to tissue homeostasis over time.

FEATURED ARTICLES

3D Growth Conditions Boost Potential of Cord Blood Stem Cells



Human CB represents an exciting source of hematopoietic stem and progenitor cells (HSPCs) for application in a wide range of regenerative therapies. However, current 2D in vitro culture and expansion strategies lead to a reduction in the absolute percentage of the most primitive stem cell number over time, so reducing the regenerative potential of CB. A new *STEM CELLS TRANSLATIONAL MEDICINE* study from the laboratories of Shay Soker and Graça Almeida-Porada (Wake Forest Institute for Regenerative Medicine, North Carolina, USA) recently explored CB culture using conditions that mimic the 3D fetal liver niche of primitive HSPCs [5]. To this end, Mokhtari et al. developed a 3D scaffold constructed from extracellular matrix components seeded with liver or bone marrow cells and, encouragingly, the recreation of a 3D niche inhibited the decrease in the proportion of primitive HSPCs during culture and expansion, irrespective of the cell type used. Overall, this new study establishes that switching from 2D to 3D cell culture conditions can boost the regenerative potential of human CB.

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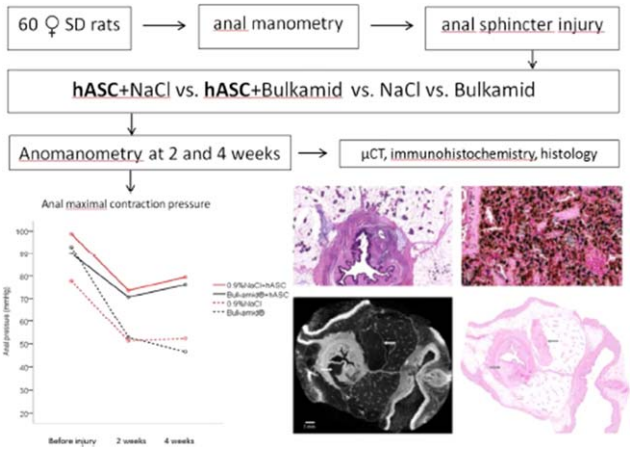
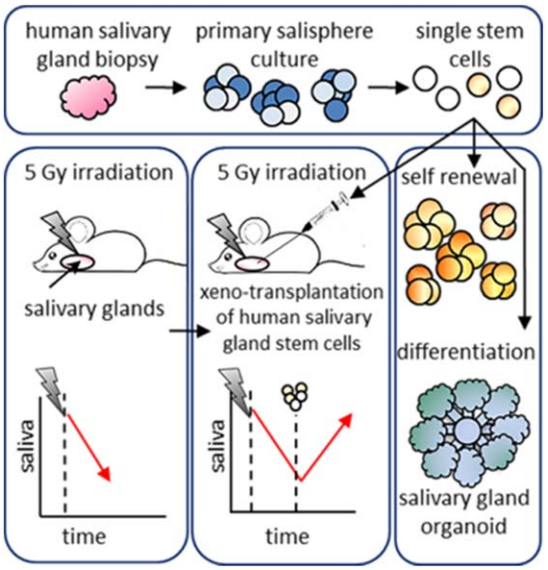
Treating Anal Sphincter Injury with Adipose Stem Cells

Injury to the anal sphincter and the onset of AI can lead to a significant reduction in quality of life, especially in females. Currently used methods of treatment can be demanding, expensive, and associated with complications, and so many research groups have begun to explore alternative therapeutic options. The group of Kirsi Kuismanen (University of Tampere, Finland) assessed the efficacy of an ASC-based therapy in a rat AI model, and their new ***STEM CELLS Translational Medicine*** study now reports that the injection of human ASCs isolated and expanded in clinically viable conditions represents a feasible treatment option [6]. The authors now hope to follow this encouraging study with assessments in chronic injury animal models with extended follow-up periods, all as a push toward developing an effective therapy for application in human patients.

DOI: 10.1002/sctm.17-0208



Related Publications



Stem Cell Organoids in Hyposalivation Cell Therapy

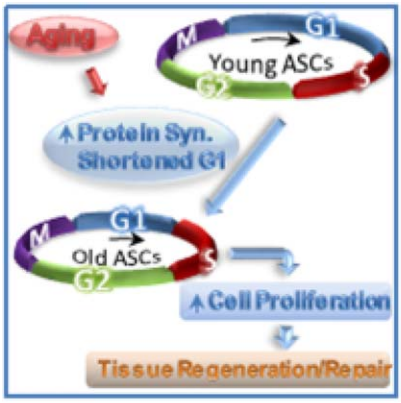
Radiation-based therapies used to treat head and neck cancers can detrimentally affect SGs, leading to hyposalivation and associated oral, dental, speaking, eating, and sleeping problems. Researchers from the group of Rob P. Coppes (University of Groningen, The Netherlands) isolated and cultivated healthy adult human SG stem/progenitor cells in 3D organoids in the search for a possible regenerative therapy for this unfortunate side-effect [7]. In their ***STEM CELLS*** study, the authors established that SG stem/progenitor cells cultured in 3D organoids self-renewed, differentiated, and following transplantation into a mouse disease model, efficiently engrafted and restored glandular function. The authors hope that 3D organoid culture of SG stem/progenitor cells will soon lead to an effective treatment for human patients.

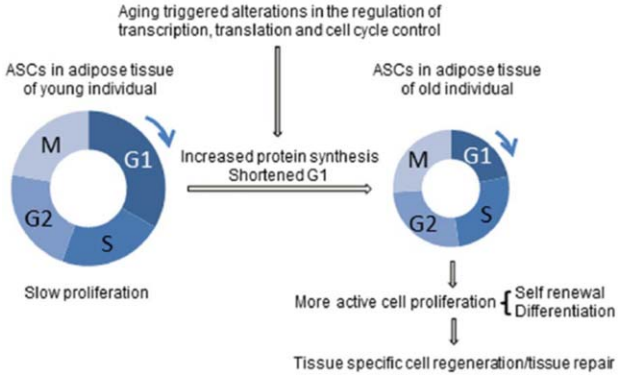
DOI: 10.1002/stem.2278

The Telltale Signs of Aging Adipose Stem Cells

The study of normal adult stem cell aging may provide new understanding into associated detrimental processes in vitro and in vivo and suggest possible preventative courses of action. Researchers from the laboratory of Ivona Percec (University of Pennsylvania, Philadelphia, USA) sought to describe the aging process of primary human ASCs by studying alterations to genome-wide transcriptional networks in a model of chronological aging. Their ***Stem Cells*** study indicated that ASC aging mechanisms differed from more differentiated cells, with ASCs displaying age-dependent increases in the expression of genes related to cell cycle progression and translation initiation, increases in nascent protein synthesis, and the abbreviation of the G1 phase of the cell cycle [8]. The authors hope that their findings may offer insight to those investigating normal human aging, developing novel anti-aging therapies, or using patient-derived ASCs in regenerative therapies.

DOI: 10.1002/stem.2592





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