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The Asymmetrex AlphaSTEM Test

Introducing a new era of quantitative stem cell research

Background: Tissue stem cells have essential roles in the renewal, repair, aging, and disease (*e.g.*, cancer) of vertebrate tissues. These involvements make them a major focus for biomedical research. Ironically, given their importance, tissue stem cells pose many challenges to scientific investigation. Their tissue fractions are extremely low (typically as low as 1 per thousand tissue cells), they are difficult to isolate, and it is difficult to expand their numbers by culturing. A particularly troublesome, long-standing barrier to their investigation has been the lack of a means to count them specifically. This difficulty has persisted for more than half a century because of the well known lack of specific molecular biomarkers that identify tissue stem cells, but not their more numerous progeny, early committed progenitor cells. Asymmetrex recently solved the specific tissue stem cell counting problem with its AlphaSTEM Test technology. Asymmetrex now offers a contract service for determining the specific stem cell fraction of any cell culture population.

Applications for suppliers of tissue stem cell culture products: There are many brands of specialized culture media and growth factors on the market for the purpose of increasing the production of tissue stem cells. These products also cause the expansion of committed progenitor cells, which significantly outnumber stem cells. Previously, the lack of specific biomarkers for tissue stem cells made it impossible to evaluate the effects of cell culture products on tissue stem cells, which are the desired targets. As shown in Fig. 1, the AlphaSTEM test can be used to evaluate the effects of stem cell culture products on tissue stem cells specifically.

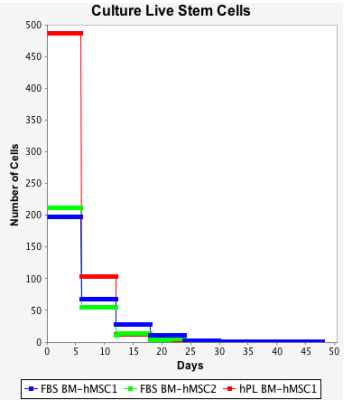

Fig. 1. An example of the use of the AlphaSTEM Test to detect and quantify the effect of human platelet lysate on serial cultures of human bone marrow-derived mesenchymal stem cells. Both human platelet lysate (**hPL, red**; Cook Regentec)-supplemented and fetal bovine serum (**FBS**)-supplemented hMSC cultures (from two independent donors, **hMSC1** and **hMSC2, blue and orange**) exhibit a decline in stem cell fraction with serial passage intended for stem cell expansion. The decline in tissue stem cell number with successive culture passages is predicted due to continued asymmetric self-renewal by tissue stem cells in culture (1,2). After the first six days of culture, hPL-supplemented cultures produce >75% more stem cells that FBS-supplemented cultures ($p = 0.012$). The initial stem cell fraction corresponds to approximately 1 stem cell per 1000 total cells ($p = 0.004$). Published data from Heathman *et al*., 2016 was used for this analysis (3).

The AlphaSTEM Test Service: The AlphaSTEM Test service has been validated for stem cells from six different tissues. These include lung, liver, hematopoietic cells for bone marrow and cord blood, and mesenchymal stromal cells from bone marrow and amniotic fluid. The service has been certified for detecting both stem cell-toxic and stem cell-activating agents. In addition to stem cell fraction, the AlphaSTEM Test provides other stem cell-specific cell kinetics factors like generation time, self-renewal rate, and death rate. The AlphaSTEM Test is also the first technology that can delineate effects on tissue stem cells from effects on their lineage-committed progeny cells.

For more information visit: http://asymmetrex.com/our-services/adult-stem-cell-counting/

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2. Paré J-F & Sherley JL (2006) Biological Principles for Ex Vivo Adult Stem Cell Expansion. In *Current Topics in Developmental Biology*, ed. G. Schatten, Elsevier, Inc. (San Diego), Vol. 73, pp. 141-171.
3. Heathman TRJ *et al*. (2016) Scalability and Process Transfer of Mesenchymal Stromal Cell Production from Monolayer to Microcarrier Culture Using Human Platelet Lysate. *Cytotherapy* 18, 523-535.