Effect of BM-HPME® Free Protein on hBM-MSCs in Benchtop Bioreactor with Microcarriers

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INTRODUCTION
Mesenchymal stem cell (MSC)-based therapies have great potential for treating many age-related diseases. When harvested from human bone marrow (hBM), these cells are relatively scarce and thus is necessary for the cells to be expanded to achieve the necessary numbers needed for any therapeutic application and for many research applications. In order for the potential of MSCs to be unlocked, a strategy must be developed to expand these cells in the most efficient and effective way possible. Here we present a method to expand MSCs in a benchtop bioreactor with microcarriers and quantify the effect of the addition of bone marrow-high performance microenvironment (BM-HPME®) free protein (FP) on this expansion.

METHODS
Fig. 1) Extracellular matrix (ECM) or BM-HPME® was produced by hBM-MSCs.

RESULTS
Fig 3) Total cell counts, SSEA4 expression, SSEA4 positive cell counts, and fold change for each experiment (E01-E03)

CONCLUSIONS
• MSCs, overall, appeared to respond positively to the addition of the ECM proteins (ECMs) derived from BM-HPME® as demonstrated by the overall increase in proliferation and SSEA4 positive cell proliferation.
• More experimentation would need to be performed in order to assess why the second experiment showed the opposite trend as the first and third.
• More consistent results could potentially be achieved if the mechanism by which the FP was affecting the cells (via soluble or adherent factors) was investigated and better understood through additional experimentation.

FUTURE WORK
Fig 4) Plan to investigate whether soluble or adherent factors caused observed increase in proliferation and preliminary data

Fig. 4) MSCs were isolated from hBM, cultured, detached, counted, seeded into 6 well plates for each experimental condition, cultured, detached, counted, and FACS preparation and analysis were performed. FP coating appeared to promote better cell attachment and proliferation. A) For media additive condition, 100 μg/mL of FP was added with cell suspension. For FP coating condition, 100 μg/mL of FP was added in ttm of 1X PBS and plate was incubated for 1 hour at 37°C before seeding. B) Image of FP coating after incubation and aspiration of PBS. C) Images of TCP, MA, and coating conditions (left to right) the day after seeding. D) Images of TCP, MA, and coating on day 5 before detaching. E-H) Cell counts, SSEA4 expression, SSEA4 positive cell number, and SSEA4 fold change were found as previously described.

INTERNSHIP OVERVIEW
• I chose to do an internship because I desired an experience with biomedical engineering in industry to compare and contrast with my experience in academia.
• I accomplished carrying out several projects from beginning to end during my internship.
• This helped me gain professional experience by giving me a better understanding of what industry, specifically working for a startup, looks like.
• I loved my experience at StemBioSys.
• I would definitely recommend that other students do a similar internship.

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