INVESTIGATION OF THE VOLATILOME OF HUMAN EMBRYONIC STEM CELLS USING SELECTED ION FLOW TUBE MASS SPECTROMETRY

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INTRODUCTION

Human pluripotent stem cells (hPSCs), such as embryonic stem cells (hESCs) and induced pluripotent stem cells, have gathered tremendous attention as they have multiple applications in regenerative medicine. It is not surprising that their cellular mechanisms, including metabolism, are being intensely studied. However, the current knowledge regarding hPSC metabolism is limited, with most information resulting from cancer studies' assumptions[1]. Another drawback is measuring the diversity of cells' metabolomes, which requires complex analytical instruments, like mass spectrometry, that are often destructive and need complicated sample preparation procedures[2,3].

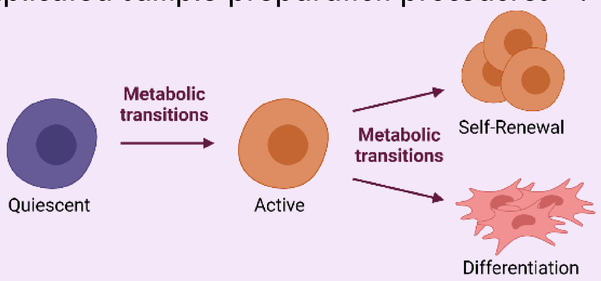
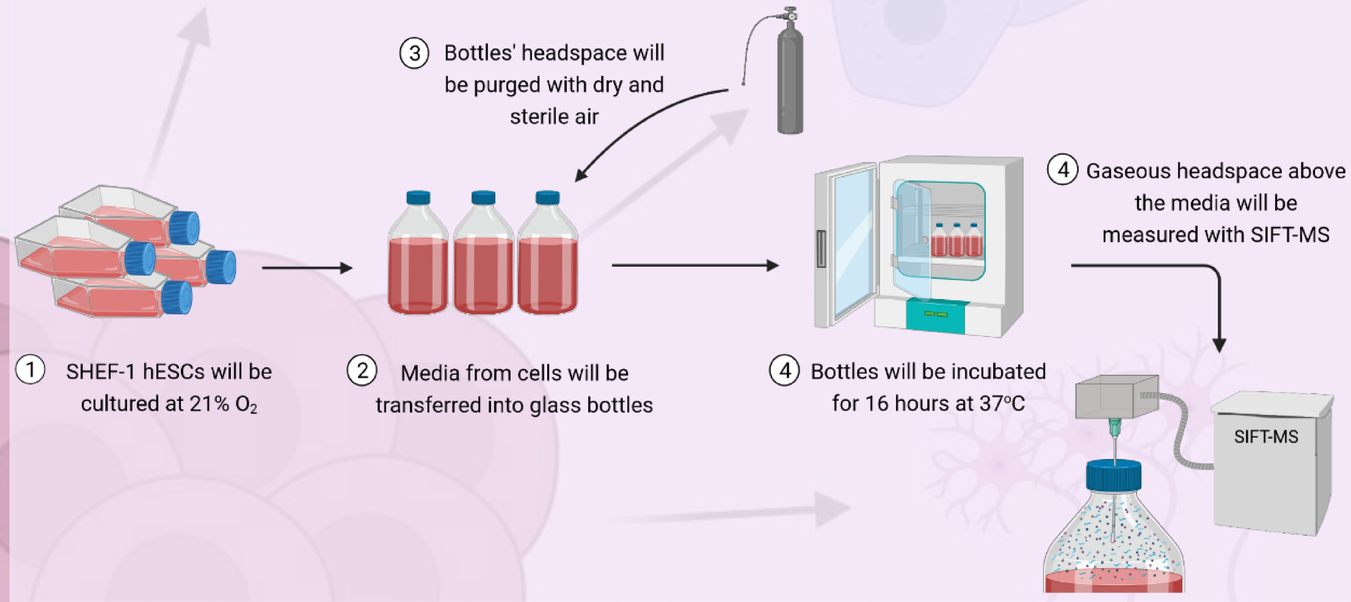


Figure 1 - Defining the volatile profile of stem cells during quiescence, self-renewal, and differentiation may reveal the metabolic processes that impact changes in their state. Adapted from reference 4.

Analysing the volatile metabolites of stem cells in culture could give invaluable information regarding their metabolic processes (Fig.1). An efficient strategy to detect such volatiles is selected ion flow tube-mass spectrometry (SIFT-MS). SIFT-MS allows for accurate analyses of humid gaseous samples for several compounds simultaneously in real-time, without the need for sample preparation and collection that can compromise the sample[3].

The aim of this study is to identify a Volatile Organic Compound (VOC) profile of hESCs using SIFT-MS.

METHODS



RESULTS

We will utilise a kinetic library (a list of compounds and their known mass-to-charge ratios) to look at 10 expected VOCs (acetone, acetaldehyde, ethanol, butanol, pentanol, DMS/ethanethiol, hexanal, butyric acid, pentene, putrescine) in the headspace of SHEF-1, which have been identified in a previous study[5].

This study's results will be further compared to other hPSC lines and oxygen conditions (hypoxia and physioxia) to investigate differences in VOC profiles.

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REFERENCES

[1] Zhang J, et al. (2012) *Cell stem cell* 11(5):589-595. [2] Dunn WB, et al. (2005) *Analyst* 130(5):606-625. [3] Rutter AV, et al. (2013) *Analyst* 138(1):91-95. [4] Perez-Ramirez CA & Christofk HR (2021) *Cell stem cell* 28(3):409-423. [5] Al-Zubaidi MA (2018) Doctoral dissertation, Keele University

CONCLUSIONS & FUTURE WORK

SIFT-MS could potentially be employed as an additional non-invasive technique to identify and characterise stem cells in culture. Furthermore, we hope that this study will contribute to the establishment of a VOC blueprint for quiescence, self-renewal and differentiation, which, in turn, will enhance the understanding of metabolome dynamics of stem cells.