The Efficacy of Cyranose in Detecting In Vitro Volatile Organic Compounds

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Background and Hypothesis

Electronic-noses are a subtype of electronic-sensing technology designed to reproduce human smell via sensor arrays and pattern recognition algorithms. Specifically, they can detect headspace volatile organic compounds (VOCs), which are end products of human metabolism (normal and disease-specific) mainly excreted in the breath, urine, and feces. VOCs are often emitted before the onset of clinical symptoms of many diseases, making them useful screening biomarkers. Additionally, the portable, inexpensive, and non-invasive nature of e-noses allows for easy clinical implementation for point-of-care (POC) disease screening/diagnosis. We hypothesize that Cyranose, one e-nose model, can differentiate headspace VOCs between healthy cells and cells stressed with an in vitro inflammatory state.

Project Methods

Human Intestinal Epithelial Cells (HIEC-6s) and Umbilical Stem Cells (USCs) were cultured in their respective 50 mL complete media at 37^{o} C in 5% CO_2. Upon reaching appropriate confluence, cells were washed using PBS and passaged with TrypLE Express. Cells were counted with a hemocytometer and Trypan blue exclusion, then added to a 12 well plate and exposed to either TNF-α (50 ng/mL), LPS (200 ng/mL), or hypoxia (5% O_2) for 24 hours. Supernatant (1.5 mL) was added to Eppendorf tubes, sealed with parafilm, and heated to 40^{o} C for 30 minutes. Headspace VOC profiles were analyzed with Cyranose and compared to controls.

Results

Using the “identify” function on Cyranose, it was unreliable in correctly distinguishing VOCs between HIEC-6s and USCs from their controls under all treatment conditions. While Cyranose sensors did generate smellprint profiles that showed differences between HIEC-6s and USCs against controls with LPS treatment, small sample sizes limit these results.

Conclusion and Future Directions

This study demonstrates that new method designs are necessary when identifying in vitro VOC profiles using Cyranose. Future considerations should include the concentration of treatments/cells, cell types, treatment duration, supernatant volume, number of samples prepared, heatblock temperature, and/or a different e-nose model.