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In situ monitoring reveals cellular environmental instabilities in human pluripotent stem cell culture

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Abstract:

Mammalian cell cultures are a keystone resource in biomedical research, but the results of published experiments often suffer from reproducibility challenges. This has led to a focus on the influence of cell culture conditions on cellular responses and reproducibility of experimental findings. Here, we perform frequent in situ monitoring of dissolved O₂ and CO₂ with optical sensor spots and contemporaneous evaluation of cell proliferation and medium pH in standard batch cultures of three widely used human somatic and pluripotent stem cell lines. We collate data from the literature to demonstrate that standard cell cultures consistently exhibit environmental instability, indicating that this may be a pervasive issue affecting experimental findings. Our results show that in vitro cell cultures consistently undergo large departures of environmental parameters during standard batch culture. These findings should catalyze further efforts to increase the relevance of experimental results to the in vivo physiology and enhance reproducibility.

Keywords: mammalian cell culture, reproducibility, in situ monitoring, pluripotent stem cell lines, environmental instability