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An Inexpensive Incubator for Mammalian Cell Culture Capable of Regulating O_2, CO_2, and Temperature

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Abstract:

Mammalian cell culture is widely used for discovery and development. Recently, increasing attention has been paid to the importance of maintaining physiologically-relevant conditions in cell culture. Although oxygen level is a particularly important consideration, it is rarely regulated by experimentalists. The atmospheric O_2 levels commonly used in cell culture are significantly higher than those experienced by most mammalian cells *in vivo*, leaving cells susceptible to oxidative damage, senescence, transformation, and otherwise aberrant physiology. A barrier to incorporating O_2 regulation into most cell culture workflows has been the expense of investing in new equipment, as the vast majority of laboratory CO_2 incubators do not regulate O_2. Here, we describe an inexpensive (<CAD 1000), portable and user-friendly O_2/CO_2 incubator that can establish and maintain physiological O_2, CO_2, and temperature values within their physiological ranges. We used an Arduino-based approach to add O_2 and CO_2 control to a temperature-regulating egg incubator. Our incubator was tested against a commercial laboratory O_2/CO_2 incubator. Using Presens OxoDish technology, we demonstrate that at a setpoint value of 5% gas-phase incubator O_2, media O_2 averaged 5.03 (SD = 0.03) with a range of 4.98–5.09%. MCF7, LNCaP and C2C12 cell lines cultured in the incubator displayed normal morphology, proliferation, and viability. Culture for up to one week produced no contamination. Thus, our incubator provides an inexpensive means of maintaining physioxia in routine mammalian cell culture.

Keywords: oxygen, physioxia, hypoxia, cell culture, incubator