Controlled Gas Exchange in Whole Lung Bioreactors

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Description:

- A bioreactor system for whole rat lungs that controls dissolved gas levels (Fig. 1A-B). The system is able to quantify and predict the gas exchange within the bioreactor using a lumped parameter model (Fig. 1C, 2A-B).
- This system enables the maintenance of alveolar levels (100 mmHg) of dissolved oxygen for the duration of lung culture.
- The mathematical model enables non-invasive and real-time estimation of cell number and the proliferative state of lung tissue simply through dissolved oxygen measurements.

Figure 1 - Design of the whole lung bioreactor for controlling gas exchange.
- \( C^* \): concentration of oxygen entering the evaporative element.
- \( C^* \): concentration of oxygen leaving the lung.
- \( Q \): rate of oxygenation of lung tissue out of the bioreactor.
- \( f_B \): blood flow rate through the proliferative lobe.
- \( f_R \): blood flow rate through the regenerative lobe.

Figure 2 - Gas Exchange Characterization Results.


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