# Introduction:

Extracorporeal membrane oxygenation (ECMO) is a type of life support that is used to in life threatening health problems. The basis of it this device is to take over the role of the heart and lungs temporarily, to

The idea with this project was to start the model based on a simple structure and add complexity on each iteration. To begin, the team first gathered the necessary equations to relate the exchange between the alveolus and capillary beds.

In this report, we examine the primary engineering concepts, features, and characteristics of a model lung/capillary bed. We estimate the volume of each compartment, identify major chemical components, and evaluate the model’s performance during a full respiratory cycle. This information will be invaluable for the development of an ECMO device that mimics all critical lung functions.

Primary Engineering Concepts and Units Selection:

Alveoli: The primary engineering concept in the alveoli is gas exchange, where oxygen (O2) and carbon dioxide (CO2) are exchanged between the lungs and blood. The large surface area provided by the alveoli enables efficient gas exchange, driving the selection of this unit.

Capillaries: The primary concept in the capillaries is convection and diffusion, where blood flow transports O2 and CO2 between the alveoli and the rest of the body. The close proximity of the alveoli and capillaries facilitates efficient gas exchange, supporting the choice of this unit.

Compartment Volumes

Alveoli: The estimated volume of the alveoli is an adult human is approximately 3-4 liters.

Capillaries: The estimated volume of the capillary bed in the lungs is approximately 70-100 mL.

Major Chemical Components:

To develop o comprehensive ECMO device, the model must track O2, and CO2. These components are critical for maintaining homeostasis, as the lungs are responsible for gas exchange, acid-base balance, and maintaining proper humidity levels.

Respiratory Cycle Analysis:

For the purpose of this analysis, we assume a standard atmospheric condition with a temperature of 20\degreeC, a pressure of 760 mmHg, and a relative humidity of 50%.

Partial pressures, volumes and percent composition of each chemical constituent during one full respiratory cycle (inhalation and exhalation) are as follows:

Inhalation:

O2: 159 mmHg, 21% by volume

CO2: 0.3 mmHg, 0.04% by volume

Exhalation:

O2: 120 mmHg, 16.3% by volume

CO2: 40 mmHg, 5.3% by volume

Gas flow rates during inhalation and exhalation:

O2: Inhaled at ~550 mL/min and exhaled at ~400 mL/min

CO2: Inhaled at ~7 mL/mi and exhaled at ~200 mL/min

Strengths and Weaknesses:

Strengths:

The model accurately represents the primary physiological features of the lung and capillary bed, enabling the simulation of gas exchange and transport.

Weaknesses:

The model does not account for dynamic changes in blood pH or other physiological factors that may affect gas exchange efficiency.

# Conclusion:

This report provides a comprehensive analysis of a model lung/capillary