Lung Transplant Theory: Mechanical Pumps and How the Body Accepts Foreign Ventilators

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The purpose of this initial project stage was to identify parameters needed for artificial lungs to be optimally functional in the human body and lay the foundation for future research regarding body-safe material alternatives. We hypothesized that if the artificial lung was made from extremely flexible material, it would have a higher percent expansion compared to the lung made from more resistant material. The experiment involved mastering the multifaceted and complex program Fusion360 to create scaled 3D models of human lungs. These printed models were then pressed into kinetic sand to make molds in which different variations of heat-molded plastic were poured. Once the plastic cooled, we created a cavity in the center and sealed the sides. A plastic molded plug with a rubber tube attached, adhered to the superior aspect of the models and facilitated the transfer of air in and out of the model lungs. The data collected didn't support the original hypothesis. It was predicted that the soft lung (more elastic) would have a higher percent expansion. However, the hard lung (more resistant) had an expansion of 34.62% before bursting, while the soft lung only had a 24% expansion before bursting, a difference of 10.62%. These findings support the conclusion that future artificial lungs will need to be similar in flexibility to the hard model lung. The hard lung was able to hold its reasonable capacity without any issue and, when challenged, maintained its max capacity for approximately 4 minutes before the structure became compromised.

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