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Blood Flow and Oxygen Transport Past an Elliptical Fiber in an Artificial Lung¹ JENNIFER ZIERENBERG, HIDEKI FUJIOKA, RONALD HIRSCHL, ROBERT BARTLETT, JAMES GROTBERG, University of Michigan - Artificial lungs are currently being developed to serve as bridges to lung transplantation with circular fibers, which are permeable to oxygen, used as the transport surface. Blood flows across the fibers while oxygen flows through the fiber lumen. The present work investigates the novel approach of using elliptical fibers as the transport medium. Steady blood flow, modeled as a Casson fluid, and oxygen transport over a single fiber are investigated for varying elliptic aspect ratios (Ar=minor radius/major radius) and orientations to flow (ϕ). The parameters investigated are $Re = 1, 5, 10; Ar = 0.25, 0.5, 0.75, 1; \phi = 0^{\circ}, 15^{\circ}, 30^{\circ}, 45^{\circ}, 60^{\circ}, 75^{\circ}, 90^{\circ}; and$ Sc = 1000. The Casson properties of blood decrease the size and strength of recirculation(s) which when present are attached to the downstream side of the fiber. A maximum decrease of 24% in drag and an increase of 10% in transport are observed for Re = 5, Ar = 0.25 and $\phi = 0^{\circ}$ as compared to the circular fiber. The elliptic properties can thus aid in the design of artificial lungs.

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