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Surface Patterning: Controlling Fluid Flow Through Dolphin and Shark Skin Biomimicry[1] LAWREN GAMBLE, Smith College, AMY LANG, MICHAEL BRADSHAW, ERIC MCVAY, University of Alabama — Dolphin skin is characterized by circumferential ridges, perpendicular to fluid flow, present from the crest of the head until the tail fluke. When observing a cross section of skin, the ridges have a sinusoidal pattern. Sinusoidal grooves have been proven to induce vortices in the cavities that can help control flow separation which can reduce pressure drag. Shark skin, however, is patterned with flexible scales that bristle up to 50 degrees with reversed flow. Both dolphin ridges and shark scales are thought to help control fluid flow and increase swimming efficiency by delaying the separation of the boundary layer. This study investigates how flow characteristics can be altered with bio-inspired surface patterning. A NACA 4412 hydrofoil was entirely patterned with transverse sinusoidal grooves, inspired by dolphin skin but scaled so the cavities on the model have the same Reynolds number as the cavities on a swimming shark. Static tests were conducted at a Reynolds number of approximately 100,000 and at varying angles of attack. The results were compared to the smooth hydrofoil case. The flow data was quantified using Digital Particle Image Velocimetry (DPIV). The results of this study demonstrated that the patterned hydrofoil experienced greater separation than the smooth hydrofoil. It is hypothesize that this could be remediated if the pattern was placed only after the maximum thickness of the hydrofoil.

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