# Sharks Take a Bite Out of Infection! An Antibacterial, Reusable Bandage for Post-Operative Patients

Herbst, Hannah (School: Florida Atlantic University High School)

In the U.S., over 20 million cases of healthcare associated infections (HAIs) are reported, contributing to $3 trillion in healthcare costs and 5.9 million tons of waste annually. HAIs are currently treated with antibiotics, however antibiotic-resistant superbugs are increasing. Marine micro-fouling on wet surfaces is analogous to the proliferation of bacteria responsible for HAIs. This study had two goals: to assess marine micro-fouling on shark skin; and develop reusable, antibacterial bandages with shark skin-inspired surfaces. This study is first to quantify fouling on Blacktip shark skin (Carcharhinus limbatus) along dorsal and ventral surfaces, and mimics Bonnethead dermal denticles (Sphyrna tiburo) to create bandages. Shark skin (C. limbatus) and control petri dishes were assessed for fouling using NIH ImageJ. Samples were exposed to seawater and sunlight for 120 hours, where <3% of the skin and >98% of the control fouled. There was a positive correlation between presence of the microstructure (Engineered Roughness Index (ERI) = 15.313 µm) and inhibited bacteria growth. Shark skin denticles (S. tiburo) were Micro-CT scanned, CAD modeled, inverted, and 3D resin printed to create negative molds of shark skin with five different roughness factors (ERI between 1.972 and 16.026 µm). Bandages were created using PDMSe elastomer and assessed for growth from multiple strains of Staphylococcus, an isolate in 70% of HAIs. Bandages with similar morphology and roughness to shark skin were significantly more effective at blocking Staphylococcus adhesion and migration compared to a commercial bandage and PDMSe control. This bandage will reduce HAIs, healthcare costs, and waste.

**Awards Won:**

Intel ISEF Best of Category Award of $5,000

First Award of $3,000

Air Force Research Laboratory on behalf of the United States Air Force: First Award of $750 in each Intel ISEF Category

Serving Society Through Science: Second Award of $500