Nanotech turns to shark skin and dragonfly wings

January 23 2023

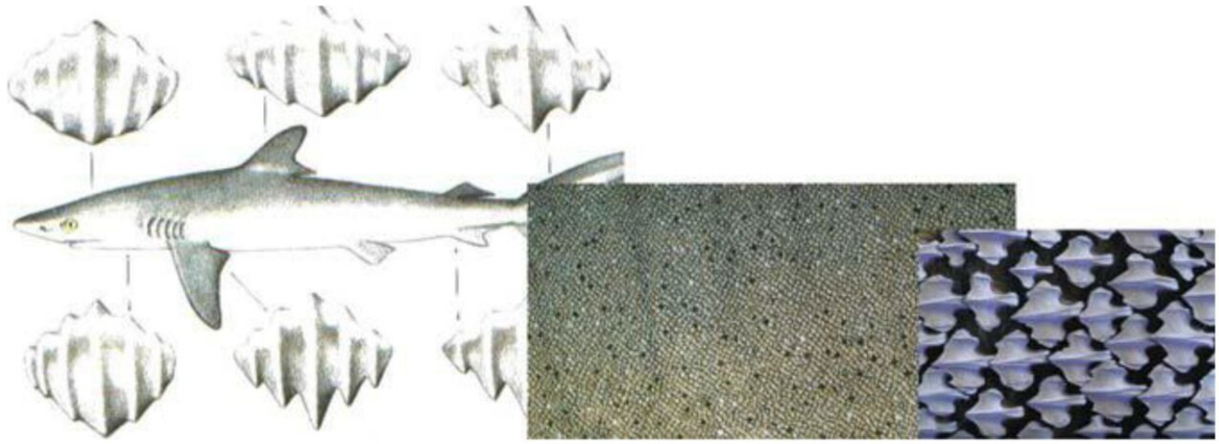

Diagram of shark scales. Credit: *Sustainability* (2022). DOI: 10.3390/su142416662

Shark skin and dragonfly wings are two of nanotechnology researchers' favorite things in new studies looking for solutions to maritime and medical mysteries.

The microscopic makeup of these natural surfaces may hold the key to better applications in human technologies, studies by Flinders University and international collaborators have found.

"Our study looked at the special structure of the ribletted surfaces of

some sharks which enables them to reduce drag and friction in fast-swimming sharks while also deterring microscopic marine organisms from adhering to their skin," says Flinders University Professor Youhong Tang, from the College of Science and Engineering.

"The shape of riblets on the skin surface influences the effectiveness of the drag reduction greatly, with the riblet surfaces performing best when aligned parallel to the flow direction."

Led by Chinese naval architecture and ocean design and engineering collaborators, the research is focusing on developing a simple biomimetic turbulent drag reduction topology on this shark skin-inspired research modeling.

This will be used to guide design of more fuel efficient marine surfaces, including cargo ships and pipelines, which also may not be as prone to attracting aquatic biofilm buildup which drags on shipping hulls.

Answers to leading scientific questions have been found in nature, with other Flinders University, La Trobe University and other researchers describing the potential of antibacterial powers of insect wings.

"The wings of dragonflies and cicadas have evolved to use the structural features of their surface to attain bactericidal properties," says Flinders University researcher Dr. Vi Khanh Truong, from the Flinders Biomedical Nanoengineering Laboratory.

"The nanopillars or nanospikes present on these natural materials physically damage the bacterial cells that settle on the nanostructures resulting in cell lysis and death.

"This study looks at these natural surfaces to provide guidelines for the design of synthetic bio-inspired materials and also create some novel

fabrication techniques used to produce biomimetic micro- and nano-structures on synthetic material surfaces."

It is estimated that infections due to antibiotic-resistant bacteria claim 700,000 lives each year. This is predicted to increase to 10 million by 2050 if drug-resistant bacteria continue evolving at the same rate.

Buildup of microbial biofilms on hospital and instrument surfaces and pose a significant challenge to human health as havens for infection-causing bacteria.

Scientists are developing antibacterial and antifouling materials to combat the increasing risk associated with bacterial infections and the evolution of drug-resistant bacteria by developing man-made coatings made from bactericidal agents such as metal derivatives or antibiotics.

Perhaps "nature knows best" is the best option in some cases.

More information: Shaotao Fan et al, Shark Skin—An Inspiration for the Development of a Novel and Simple Biomimetic Turbulent Drag Reduction Topology, *Sustainability* (2022). DOI: 10.3390/su142416662

Sruthi Venugopal Oopath et al, Nature-Inspired Biomimetic Surfaces for Controlling Bacterial Attachment and Biofilm Development, *Advanced Materials Interfaces* (2022). DOI: 10.1002/admi.202201425

Provided by Flinders University