The math of shark skin

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"Sharks are almost perfectly evolved animals. We can learn a lot from studying them," says Emory mathematician Alessandro Veneziani.

As an expert in fluid dynamics, Veneziani is particularly interested in the skin of sharks, which is not smooth – as might be expected for such a streamlined, efficient swimmer – but irregular and rough. "It's counterintuitive," Veneziani says. "One would expect that smooth skin would make a shark faster in the water but it's not true, and there is a mathematical reason."

The ridges, or riblets, on shark skin break up vortexes of water and reduce drag, a phenomena known as the riblet effect. Using differential equations, mathematicians have duplicated this effect so it can be applied to industry. Aircraft, for instance, are painted with special finishes to create a riblet effect.

Veneziani once worked on a project for a European swimwear company. They used the math of shark skin to create swimsuit fabric for competitive swimmers. Tests showed that these swimsuits could significantly reduce drag in the water, to the point that they were banned from the Olympics in 2008.

"In the Olympics, you are not allowed to swim like a shark," Veneziani says.

The time spent studying the math of shark skin was not wasted effort for Veneziani. He now applies similar principles of fluid dynamics to study

how blood flows through human arteries. His lab creates computer simulations to help doctors decide on the best course of action for patients with cardiovascular disease.

"One of the great things about mathematics is that you can gain experience in one specialty, like shark skin, and use it in a completely different area, like blood dynamics," Veneziani says. "Math is the common language of nature."

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