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THIS HUGE AMAZONIAN FISH THAT LIVES IN PIRANHA-INFESTED WATERS HAS SOME OF THE TOUGHEST SCALES ON THE PLANET

BY **KASHMIRA GANDER** ON 10/16/19 AT 11:00 AM EDT

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Scientists who studied why the scales of a huge Amazonian fish, which lives piranha-infested waters, are some of the toughest in the world hope their work could help to create armor.

In order to survive in lakes of the Amazon, the arapaima fish has evolved armor-like scales. The creature can grow up to 3 meters long, weigh 200kg and is thought to be the largest freshwater fish in the world, study co-author Wen Yang of the University of California, San Diego, Department of Nanoengineering, told *Newsweek*.

The outer layer of its scales is mineralized, providing a barrier against potential threats, like the teeth of hungry predators. But ridges and protrusions make the scales flexible, the scientistsexplained in their paper published in the journal Matter. The surface is bound by collagen to a lower layer featuring what is known as a Bouligand structure.

Resembling a twisting staircase of layers, this shape is also found in the shells of lobsters, beetles and crabs, Yang explained.

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To find out more about its hardy exterior, researchers at the University of California, San Diego, and the University of California, Berkeley, performed tests to see how much strain the scales can take.

First, the team soaked crushed arapaima fish scales in water for 48 hours. Next, they put pressure on the centre of the scales, while pulling at the edges. During this process, they noticed that the outer layer enlarged at first, before cracking and peeling away. The structure of the scales appeared to prevent these fractures from spreading.

The scientists concluded the inner and outer layers work together to enable to scales to be lightweight, flexible yet tough. The scales are among the toughest bendy biomaterials on the planet, they said.

Similar mechanisms have been found in the striped bass, however, the arapaima's scales are thicker and more mineralized, providing a useful barrier against piranhas, the authors wrote.

Robert Ritchie, senior author of the study and a professor of materials science and engineering at UC Berkeley, commented in a statement: "A window may appear strong and solid, but it has no give. If something attempted to puncture it, the glass would shatter.

"When nature binds a hard material to a soft material, it grades it, preventing this shattering effect. And in this case, the binding structure is mineralized collagen."

He said the structure of the fish's skin could be copied to create impermeable synthetic armor, although this would be a long way in the future.

Yang explained such resilient materials are a "sexy" topic among scientists in this area.

"If we have such lightweight and tough materials, our aerospace engineering will advance in a huge step," she said.

A stock image shows a close-up of the scales of the arapaima fish, similar to those which scientists studied.