

## The New York Times

---

### TRILOBITES

# Meet the Deep-Sea Dragonfish. Its Transparent Teeth Are Stronger Than a Piranha's.

Researchers say the tiny crystalline structures in the predator's fangs could inspire strong, see-through materials.

By Wudan Yan

June 5, 2019

Unassuming dragonfish lurk in the twilight zone, more than 1,600 feet under the surface of the ocean. Dark, eel-like, and roughly three and a half inches long, these deep-sea creatures glow with bioluminescence and have evolved a complex sensory system that allows them to detect even the subtlest movements in the ocean's shadowy realms, then attract and capture their prey.

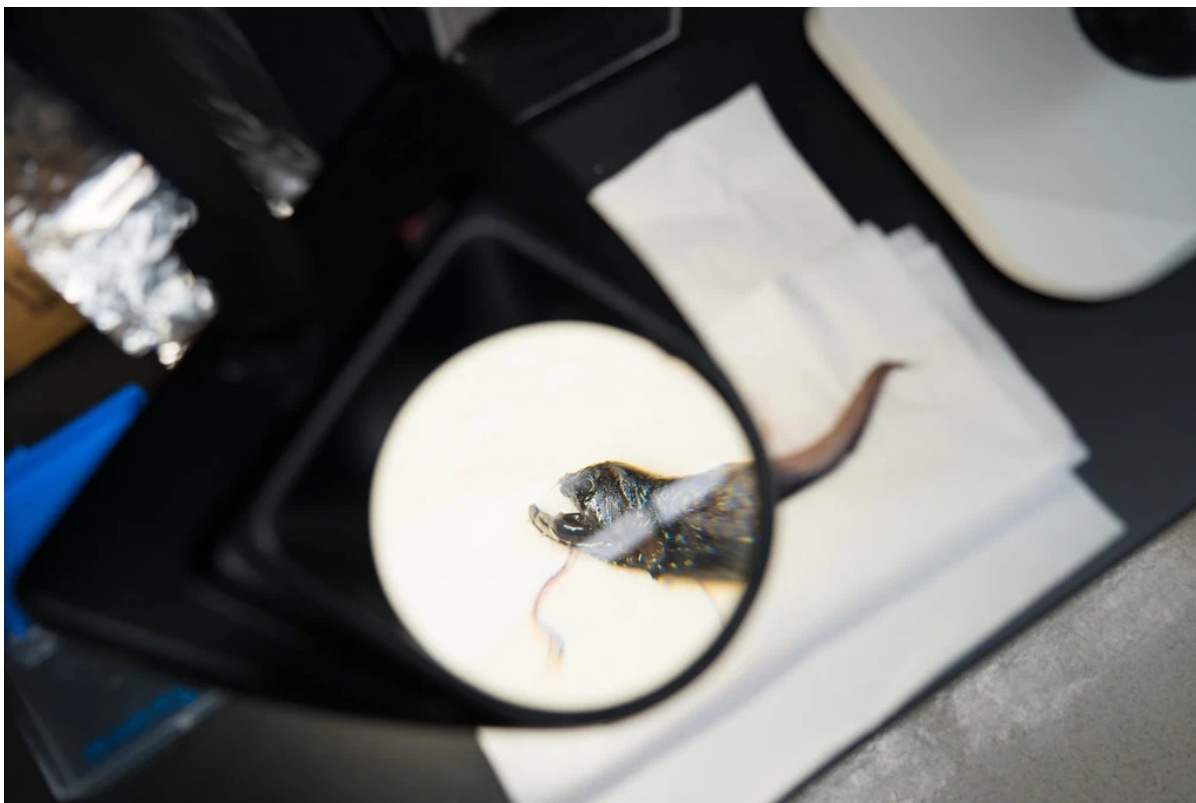
In a paper published Wednesday in the journal *Matter*, scientists demonstrated another layer of complexity to the dragonfish: the thin, jagged teeth of the species *Aristostomias scintillans* are made of nanoscale-size crystal particles. The composition and structure of these nanocrystals make the dragonfish's fangs transparent and stronger than the teeth of some of the fiercest fish predators, such as great white sharks and piranhas.

***[Like the Science Times page on Facebook. | Sign up for the Science Times newsletter.]***

The new findings have intrigued both marine biologists and material scientists. Dragonfish aren't strong swimmers, so researchers have wondered how they eat.

"They're basically hanging out in the water column," said Jacqueline Webb, a fish biologist at the University of Rhode Island. "Because they cannot be studied alive in the laboratory, any observation that can lend insights into the biology of these fishes is really valuable."

And for material scientists, understanding the details of dragonfish teeth could help lead to new synthetic materials that are both strong and transparent, said Emanuela Del Gado, a material physicist at Georgetown University, in Washington D.C. Neither she nor Dr. Webb were involved in the study.



A dragonfish under magnification. The nanocrystals in their teeth may serve as a template for new materials that are both transparent and strong.

David Baillot/UC San Diego Jacobs School of Engineering

Marc A. Meyers, the lead author of the new paper and a materials scientist at the University of California, San Diego, has long studied animals for inspiration to develop novel materials. In the beaks of toucans, the shells of abalones and leatherback turtles, and the scales of pangolins and alligators, he has discovered structures that, when synthesized or mimicked in the lab, could have potential real-world applications.

In 2017, Dr. Meyers visited his colleague Dimitri Deheyn, of the Scripps Institution of Oceanography in San Diego. Dr. Deheyn, who studies bioluminescence, had come across dragonfish in his research and long wondered why these creatures had transparent teeth. On inspecting Dr. Deheyn's frozen deep-sea fish collection — which included the ghastly looking hatchetfish and the wide-faced ratfish — Dr. Meyers was equally intrigued. Dr. Deheyn chopped off the head of one dragonfish, and gave a sample to Dr. Meyers to analyze with his colleagues at the Leibniz Institute for New Materials, in Saarbrücken, Germany.

When Dr. Meyers and his colleagues took a closer look at the teeth using electron microscopy, they were surprised to discover tiny crystals, ranging from 5 to 20 nanometers in diameter, embedded throughout the teeth. “At first, we thought that it was some type of glass,” said Dr. Meyers. The structure differed from the enamel in human teeth.

The composition of these nanocrystals make the teeth not only strong but transparent. Dragonfish may have evolved such teeth to help them become effective predators.

“Their wide-open mouth, armed with transparent, saber-like teeth, effectively disappear in the surrounding blackness,” said Dr. Webb.

The nanocrystals identified in the hooked teeth of the dragonfish may serve as a template for new materials that are both transparent and mechanically strong, said Chih-Hao Chang, who studies bioinspired nanostructures at North Carolina State University, in Raleigh.

“Biomimetics have provided many inspirations for engineers, and this is yet another great example,” Dr. Chang said. “It just goes to show how beautiful nature is all around us, and it can be really rewarding to take a closer look.”

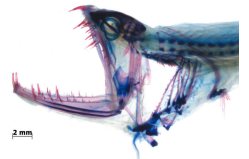
---

### Earlier reporting on deep ocean creatures

Visitors From the Ocean's Twilight Zone Nov. 21, 2018



Open Wide: Deep-Sea Fishes That Are Built to Eat Big Feb. 1, 2017



What Eats What: A Landlubber's Guide to Deep Sea Dining Dec. 19, 2017



An Ocean Mystery in the Trillions June 29, 2015



The Deep Seas Are Alive With Light Aug. 21, 2017



**Correction:** June 6, 2019

*An earlier version of this article misspelled the surname of a scientist. He is Marc A. Meyers, not Meyer.*

[READ 11 COMMENTS](#)