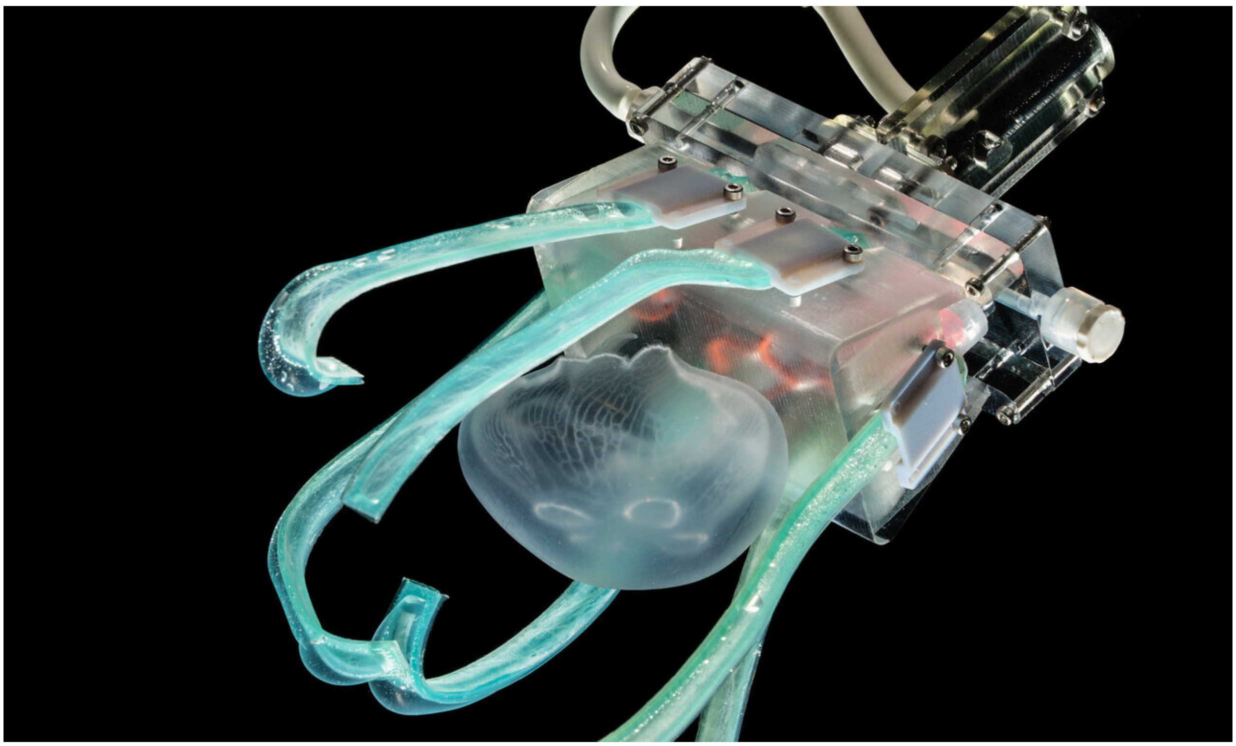
Soft robot fingers gently grasp deep-sea jellyfish

February 24 2020



Ultra-gentle robot and jellyfish. Credit: Anand Varma

Marine biologists have adopted "soft robotic linguine fingers" as tools to conduct their undersea research. In a study appearing February 24 in the journal *Current Biology*, scientists found that jellyfish held by ultra-soft robotic fingers expressed significantly fewer stress-related genes than when braced by traditional submersible grippers. Shaped like the famous noodles, this new robotic technology allows for the collection of ecological data in a gentler, less invasive manner.

"Using genomics, we confirm that newly developed soft robots are a kinder way to handle some of the slipperiest organisms—jellyfish," says first author Michael Tessler, a post-doctoral fellow at American Museum of Natural History. "With new technologies we can often make massive advances on techniques, like deep-sea animal handling."

Unlike a dog or cat, jellyfish can't hiss or whine about their discomfort. Instead, analysis of which genes they express can give insights into how they are reacting to their environment. Using gene sequencing, the researchers measured differences in jellyfish gene expression when they were swimming freely, held by the soft robot fingers, or gripped by the more standard rigid claw.

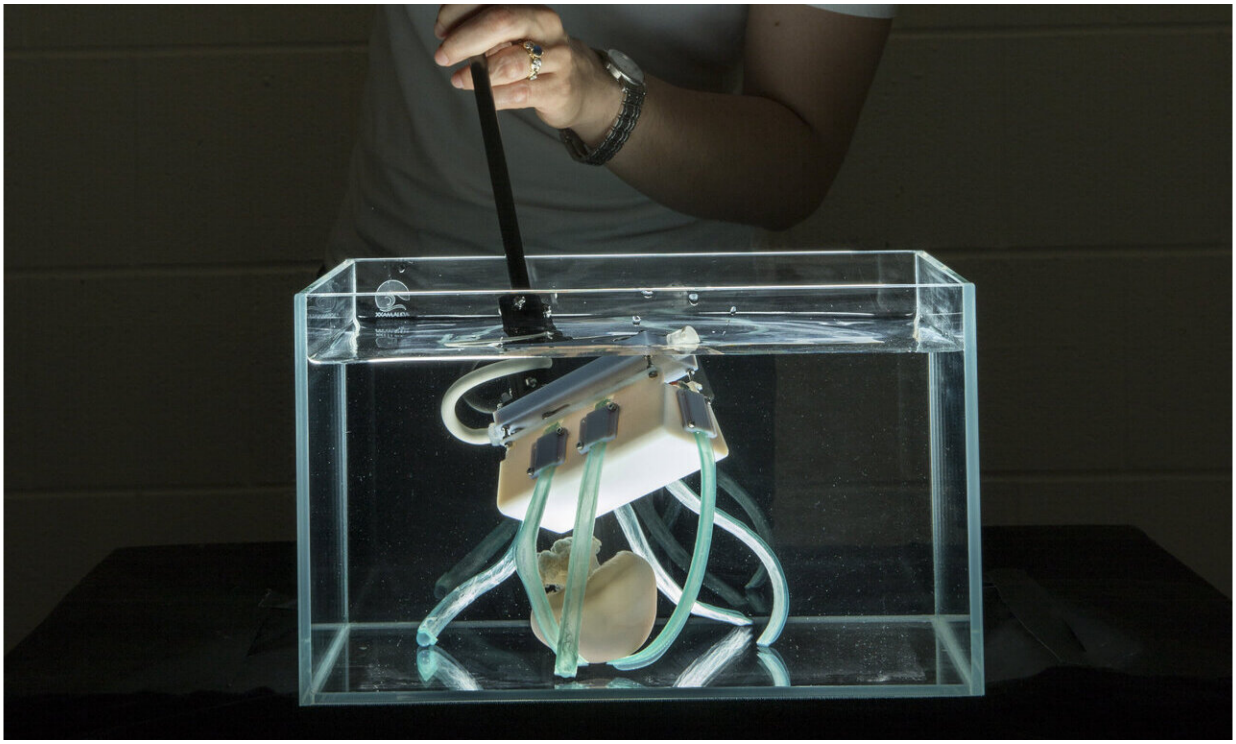
"Imagine you're sitting very happily at your desk and I take a measurement of what genes are active, and then I poke you with a claw hand. I'd then look at how differently your genes reacted compared to when you were sitting unbothered; the strength of that difference can act as an indicator of your level of stress," says senior author David Gruber, Professor of Biology, City University of New York, Baruch College & CUNY Graduate Center, Ph.D. Program in Biology.

The gently held jellies displayed gene expression patterns most like the undisturbed individuals, demonstrating their relatively calm response to capture. What's more, jellies caught by the claw expressed "repair" genes, suggesting they were priming themselves for physical harm. "I think what was interesting is that when you start harassing them with standard grippers, they immediately go into self-repair/stress because—being such a fragile organism—being stressed out is quite common for them," says Gruber. The expression of these self-repair genes was at higher levels compared to the free-swimming or gently held jellyfish.

But the impacts of this study extend far beyond just jellyfish. "We just used them as our sample organisms," says Gruber. "Now that we've shown this method can cause less stress to something as fragile as a jellyfish, it really proves our hypothesis that soft robots in the deep sea can be effective tools for all manner of delicate interactions."

These sentiments are echoed by co-author Nina Sinatra, who was a graduate student at Harvard University's Wyss Institute for Biologically Inspired Engineering when working on the study and designed the gentle robot fingers. "Selecting materials that are flexible, tough, and lightweight allow soft robots to operate robustly in the deep-sea environment while being delicate enough to safely interact with some of the most fragile marine organisms," says Sinatra. "By expanding our toolbox of materials, engineers can unlock exciting and clever solutions to challenges that would not be tractable for conventional robots."

Further, these soft robotic tools can be brought to the surface for applications of direct benefit to humans. "They could be used to harvest fruits from trees without bruising them, rehabilitate the muscles of stroke patients, and many other things that rigid-bodied robots are just too clunky and overpowered to accomplish today," says co-author Rob Wood, a Wyss Core Faculty member and professor of Engineering and Applied Sciences at Harvard's John A. Paulson School of Engineering and Applied Sciences (SEAS).



Nina Sinatra with ultra-gentle soft robotic fingers and jellyfish. Credit: Anand Varma

Historically, ocean exploration has been a rough exercise; collecting data has required ripping material from the sea floor or killing specimens to then study at the surface. With the inclusion of soft robots, it's becoming possible to take swabs of DNA and even conduct medical checkups of deep-sea organisms in real time, with little physical impact.

"By integrating soft robots into how we conduct research of the deep sea, we are reshaping our vision of the future for marine biologists," says Gruber. "It's our philosophy that we should be as gentle and careful as possible as we study and approach these new frontiers."

More information: *Current Biology*, Tessler et al.: "Ultra-gentle soft robot fingers induce minimal transcriptomic response in a fragile marine animal during handling" www.cell.com/current-biology/f … 0960-9822(20)30032-4 , DOI: 10.1016/j.cub.2020.01.032

Provided by Cell Press

Citation: Soft robot fingers gently grasp deep-sea jellyfish (2020, February 24) retrieved 20 April 2024 from https://phys.org/news/2020-02-soft-robot-fingers-gently-grasp.html

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.