Jellyfish inspires latest ocean-powered robot (w/ video)

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American researchers have created a robotic jellyfish, named Robojelly, which not only exhibits characteristics ideal to use in underwater search and rescue operations, but could, theoretically at least, never run out of energy thanks to it being fuelled by hydrogen.

Constructed from a set of smart materials, which have the ability to change shape or size as a result of a stimulus, and carbon nanotubes, Robojelly is able to mimic the natural movements of a jellyfish when placed in a water tank and is powered by chemical reactions taking place on its surface.

"To our knowledge, this is the first successful powering of an underwater robot using external hydrogen as a fuel source," said lead author of the study Yonas Tadesse.

The creators of Robojelly, from Virgina Tech, have presented their results today, 21 March, in IOP Publishing's journal Smart Materials and Structures.

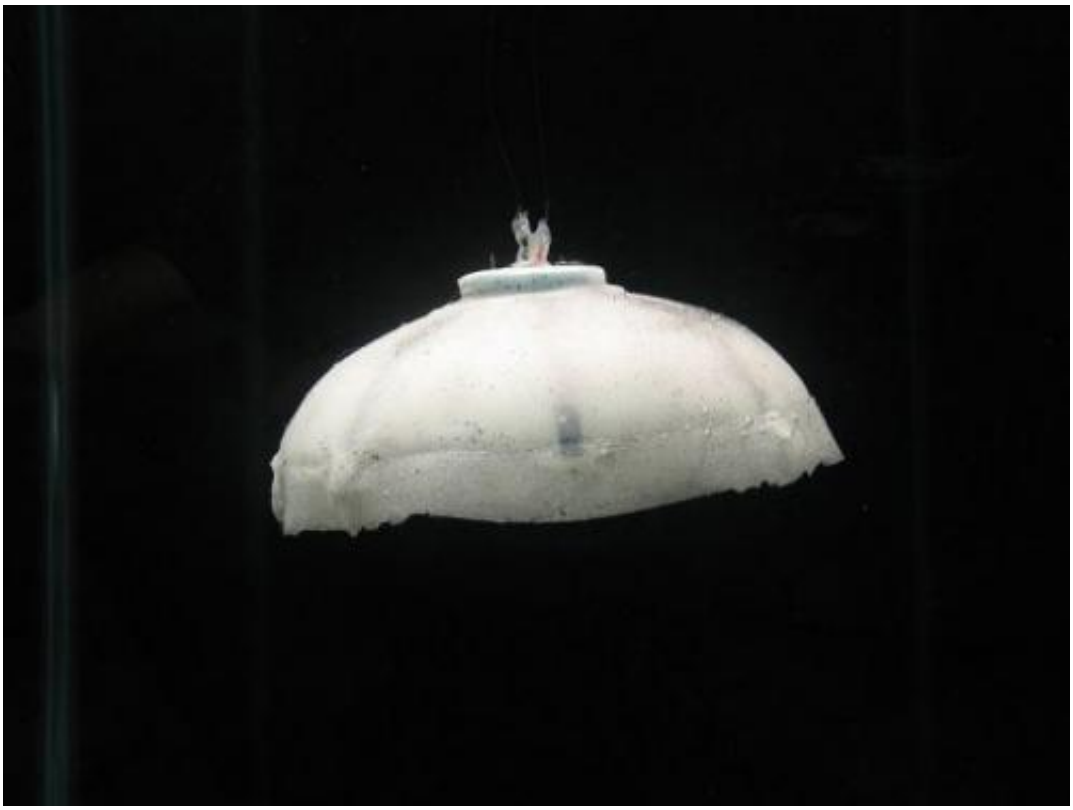
The jellyfish is an ideal invertebrate to base the vehicle on due to its simple swimming action: it has two prominent mechanisms known as "rowing" and "jetting".

A jellyfish's movement is down to circular muscles located on the inside of the bell – the main part of the body shaped like the top of an umbrella. As the muscles contract, the bell closes in on itself and ejects water to propel the jellyfish forward. After contracting, the bell relaxes and regains its original shape.

This was replicated in the vehicle using commercially-available shape memory alloys (SMA) – smart materials that "remember" their original shape – wrapped in carbon nanotubes and coated with a platinum black powder.

The robot is powered by heat-producing chemical reactions between the oxygen and hydrogen in water and the platinum on its surface. The heat given off by these reactions is transferred to the artificial muscles of the robot, causing them to transform into different shapes.

This green, renewable element means Robojelly can regenerate fuel from its natural surroundings and therefore doesn't require an external power source or the constant replacement of batteries.



This undated photo released by the BMDL and CEHMS labs at Virginia Tech in Blacksburg, Virginia, show the robotic jellyfish "Robojelly." Scientists are developing a robotic jellyfish which uses the limitless energy of sea water to power its movement, according to US Navy-backed research.

At the moment, the hydrogen-powered Robojelly has been functioning whilst being clamped down in a water tank. The researchers admit that the robot still needs development to achieve full functionality and efficiency; however, the potential can be seen in this video where the robot is powered by electricity.

"The current design allows the jellyfish to flex its eight bell segments, each operated by a fuel-powered SMA module. This should be sufficient for the jellyfish to lift itself up if all the bell segments are actuated.

"We are now researching new ways to deliver the fuel into each segment so that each one can be controlled individually. This should allow the robot to be controlled and moved in different directions," Tadesse continued.

This study is part of the MURI program sponsored by Office of Naval Research.

More information: "Hydrogen fuel-powered bell segments of biomimetic jellyfish" Tadesse Y et al 2012 *Smart Mater. Struct.* 21 045013. iopscience.iop.org/0964-1726/21/4/045013

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