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Swimming Robot Tests Theories About Locomotion In Existing And Extinct Animals

An underwater robot is helping scientists understand why four-flippered animals such as penguins, sea turtles and seals use only two of their limbs for propulsion, whereas their long-extinct ancestors seemed to have used all four.

When researchers put a joystick-controlled robot named Madeleine through her paces, they found that her top cruising speed did not increase when she used four flippers instead of two--apparently because the front flippers created turbulence that interfered with the rear flippers' ability to generate forward propulsion. Maintaining the same speed with four flippers also took significantly more energy. But Madeleine was able to make quicker starts and stops with all fours.



Madeleine, a biologically inspired underwater robot, is helping scientists and engineers better understand the most energy-efficient way to use flippers for locomotion. (Credit: John Long, Vassar College)

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Results from experiments such as these aid engineers in designing underwater autonomous vehicles and help scientists understand why certain traits survived over others during the process of evolution.

Scientists who study fossils of four-limbed aquatic dinosaurs, such as plesiosaurs, say the shape and musculature of their appendages suggests they used all of their flippers for locomotion. But over time, the benefits of two-flippered swimming won out. Extrapolating from experiments with Madeleine, scientists hypothesize that plesiosaurs benefited from using all fours to ambush prey.

Madeleine was developed by Vassar College's John Long and his colleagues at Nekton Research, LLC (Durham, N.C.) through support provided by the National Science Foundation's (NSF) Collaborative Research at Undergraduate Institutions program and the Major Research Instrumentation program.

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Penguins Waddle But They Don't Fall Down, Researchers Say

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