National Science Foundation

WHERE DISCOVERIES BEGIN

SEARCH

NSF Web Site

HOME | FUNDING | AWARDS | DISCOVERIES | NEWS | PUBLICATIONS | STATISTICS | ABOUT | FastLane

Looking for Funding?

- For the Research & Education Community
- Find Funding Opportunities
- Upcoming Due Dates

Program Areas: Select One

Quick Links: Select One

Specialized Information for: Select One

About NSF

- General Information About NSF
- View Staff Directory

Search Staff Directory

- Career Opportunities
- Contracting Opportunities
- Visit NSF

NSF Organizations

MyNSF

Sign up for email alerts & more

Login to MyNSF

Email Address:

Password (if any):

Log in

FORMERLY THE CUSTOM NEWS SERVICE

Special Notices

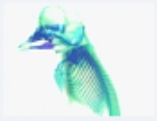
Science and Engineering Indicators 2006

Latest News

See All

U.S. National Science Foundation Celebrates Opening of Beijing Office
Released May 24, 2006

Lobsters Avoid Virus by Detecting Illness in Their Own Kind
Released May 24, 2006



Scientists Uncover New Clues to Limb Formation (and Loss) in Some Sea Mammals
Released May 23, 2006

Now Showing: Film, TV, Museums and More

See All

NSF supports great television, inspiring museum exhibits, breathtaking IMAX films, and compelling radio.

Wired to Win: Surviving the Tour de France
This giant screen film brings together the excitement of world-class sport and the frontiers of science.

Events Calendar

See All

- All Events
- Advisory Committee Meetings
- National Science Board Meetings
- Proposal Review Panels

Site Features

- NSF at a Glance
- News
- For the News Media
- Special Reports
- Discoveries from NSF Research
- Research Overviews
- Speeches & Lectures
- Multimedia Gallery
- NSF & Congress
- Classroom Resources
- NSF-Wide Investments
- Science and Engineering Statistics
- Search NSF Awards

Need Help?

- Help Center
- Our New Design
- How Do I Find...?

FIRSTGOV.gov

- No Fear Act
- Performance Assessment

Policies and Important Links | Privacy | FOIA | Help | Contact NSF | Contact Web Master | SiteMap

The National Science Foundation, 4201 Wilson Boulevard, Arlington, Virginia 22230, USA
Tel: (703) 292-5111, FIRS: (800) 877-8339 | TDD: (800) 281-8749

Last Updated: Apr 17, 2006
Text Only

Discoveries

Discoveries
Search Discoveries
About Discoveries

Discoveries by Research Area
Arctic & Antarctic
Astronomy & Space
Biology
Chemistry & Materials
Computing
Earth & Environment
Education
Engineering
Mathematics
Nanoscience
People & Society
Physics

Discovery

Swimming Robot Tests Theories About Locomotion in Existing and Extinct Animals

May explain why four-flippered swimmers now use only two

Madeleine is helping scientists and engineers better understand how flippered animals swim.
Credit and Larger Version

May 30, 2006

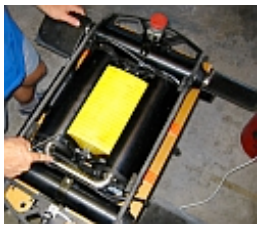
An underwater robot is helping scientists understand why four-flippered animals such as penguins, sea turtles and seals use only two of their limbs for propulsion, whereas their long-extinct ancestors seemed to have used all four.

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.

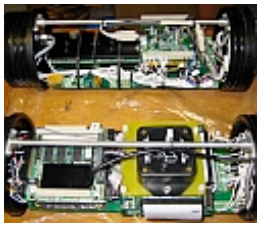
Results from experiments such as these aid engineers in designing underwater autonomous vehicles and help scientists understand why certain traits survived over others during the process of evolution.

Aquatic dinosaurs, called plesiosaurs, apparently used all four appendages for swimming.
Credit and Larger Version

Researchers use the diving facility at Vassar College to test Madeleine's performance.
Credit and Larger Version



Madeleine's swim skin comes off after a dip.
Credit and Larger Version



Bottles under Madeleine's swim skin house her computer, motor and batteries. Credit and Larger Version

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.

Long was recently interviewed on "The Daily Planet," a program of Discovery Channel Canada. To watch the interview and see Madeleine in action, click here.

--Randy Vines

Investigators
John Long

Related Websites
Madeleine-related publications:
http://faculty.vassar.edu/jolong/jolong.html

Print this page

The National Science Foundation, 4201 Wilson Boulevard, Arlington, Virginia 22230, USA
Tel: (703) 292-5111, FIRS: (800) 877-8339 | TDD: (800) 281-8749

Last Updated:
May 30, 2006

Text Only

Discoveries

Discoveries
Search Discoveries
About Discoveries

Discoveries by Research Area
Arctic & Antarctic
Astronomy & Space
Biology
Chemistry & Materials
Computing
Earth & Environment
Education
Engineering
Mathematics
Nanoscience
People & Society
Physics

All Images

Discovery

Swimming Robot Tests Theories About Locomotion in Existing and Extinct Animals

Back to article | Note about images

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*

Download the high-resolution JPG version of the image. (985 KB)

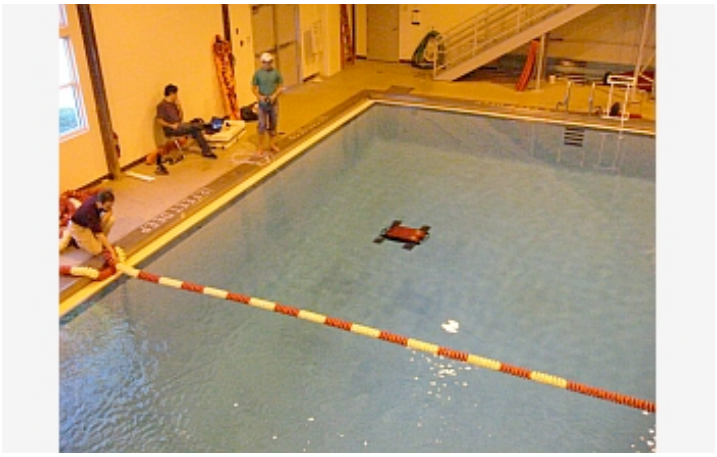
Use your mouse to right-click (or Ctrl-click on a Mac) the link above and choose the option that will save the file or target to your computer.

Scientists believe that unlike modern four-flippered animals, aquatic dinosaurs, called plesiosaurs, used all of their appendages for swimming. Madeleine is helping discover why the change to modern two-flippered swimming occurred. This plesiosaur representation was modeled after a skeletal fossil at the American Museum of Natural History in New York.

Credit: *Researched, modeled and composited by Frank DeNota.*

Download the high-resolution JPG version of the image. (9.9 MB)

Use your mouse to right-click (or Ctrl-click on a Mac) the link above and choose the option that will save the file or target to your computer.

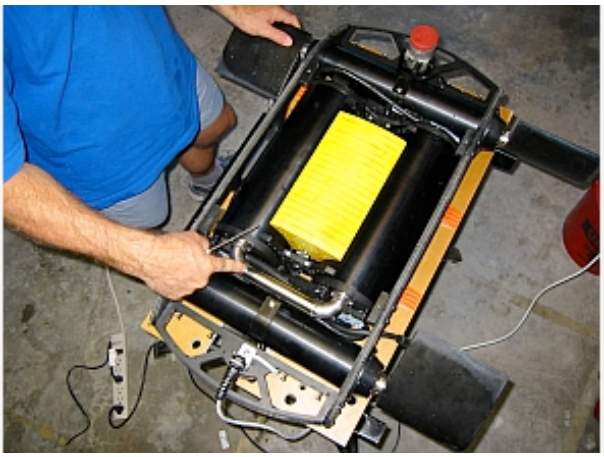


Undergraduate researchers use the diving facility at Vassar College to test Madeleine's performance.

Credit: *John Long, Vassar College*

Download the high-resolution JPG version of the image. (1.1 MB)

Use your mouse to right-click (or Ctrl-click on a Mac) the link above and choose the option that will save the file or target to your computer.

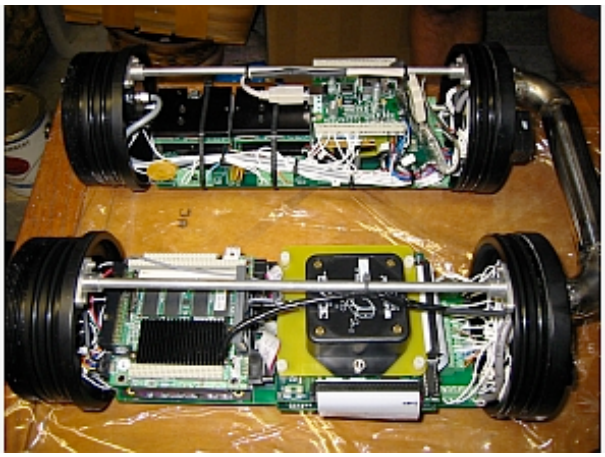


Madeleine's swim skin comes off after a dip. The oscillation of each flipper can be controlled independently to test the impact of different gaits on her motion.

Credit: *John Long, Vassar College*

Download the high-resolution JPG version of the image. (896 KB)

Use your mouse to right-click (or Ctrl-click on a Mac) the link above and choose the option that will save the file or target to your computer.



Waterproof black bottles under Madeleine's swim skin house her computer, motor and batteries.

Credit: *John Long, Vassar College*

Download the high-resolution JPG version of the image. (983 KB)

Use your mouse to right-click (or Ctrl-click on a Mac) the link above and choose the option that will save the file or target to your computer.

Print this page

The National Science Foundation, 4201 Wilson Boulevard, Arlington, Virginia 22230, USA
Tel: (703) 292-5111, FIRS: (800) 877-8339 | TDD: (800) 281-8749

Last Updated:
May 04, 2006
Text Only