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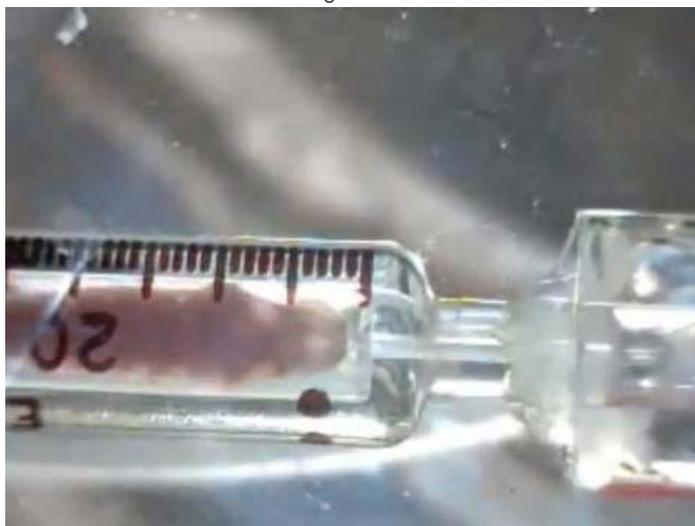
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Origins Of Vertebrate Air Breathing Possibly Uncovered

OCTOBER 16, 2012 BY NATHAN [View comments](#)

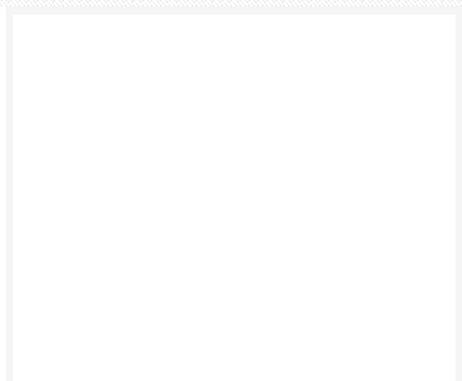


Researchers from the University of Alaska Fairbanks have recently identified what they believe to be the ancestral trait that led to the vertebrate evolution of air breathing.



"To breathe air with a lung you need more than a lung, you need neural circuitry that is sensitive to carbon dioxide," said Michael Harris, a UAF neuroscientist and lead researcher on a project investigating the mechanisms that generate and control breathing.

"It's the neural circuitry that allows air-breathing organisms to take in



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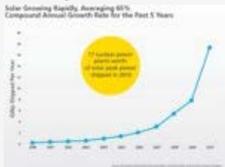
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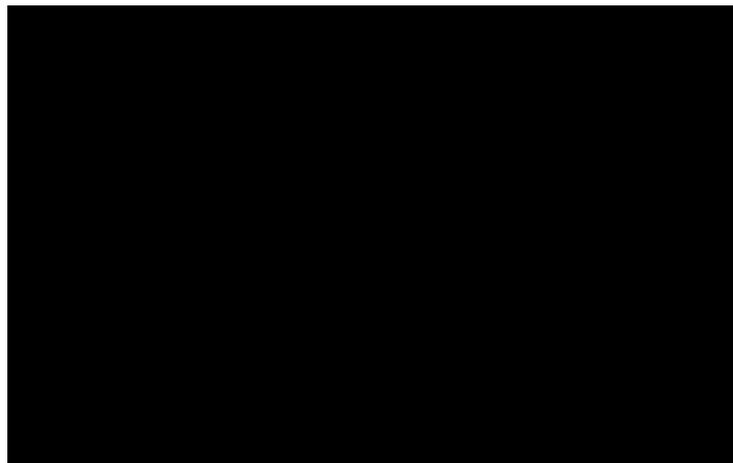
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oxygen, which cells need to convert food into energy, and expel the waste carbon dioxide resulting from that process,” he said. “I’m interested in where that carbon-dioxide-sensitive neural circuit, called a rhythm generator, came from.”

The researchers are of the mind that air breathing likely didn’t evolve in an animal that possessed a lung, but in one that had a rhythm generator.

“We try to find living examples of primitive non-air-breathing ancestors, like lamprey, and then look for evidence of a rhythm generator that did something other than air breathing,” Harris said.

Lampreys are one of the most ancient types of fish that are still living, they possess many characteristics that are similar to some the early vertebrates. Particularly, they don’t have lungs and they don’t breathe air. When they are larvae, they dig small tubes into soft ground and breathe there by pumping water through their bodies. Occasionally they pump in mud or other debris that clogs their tube, when that happens “they use a cough-like behavior to expel water and clear the tube. A rhythm generator in their brain controls that behavior.”



The clip shown above demonstrates the behavior, and “the difference between gill ventilation and a ‘cough’ in a larval lamprey. The ‘cough’ occurs at about the 9 second mark.”

“We thought the lamprey ‘cough’ closely resembled air breathing in amphibians,” said Harris. “When we removed the brains from lampreys and measured nerve activity that would normally be associated with breathing, we found patterns that resemble breathing and found that the rhythm generator was sensitive to carbon dioxide.”

Air breathing first emerged in fish species and allowed the eventual

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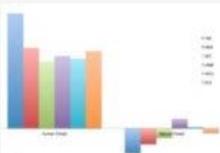


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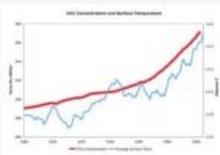
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colonization of land by vertebrates. If there had never been a carbon-dioxide-sensitive rhythm generator, it's very possible that the structure that became would have become something else or simply disappeared, never functioning as a lung.

"The evolution of lung breathing may be a repurposing of carbon dioxide sensitive cough that already existed in lungless vertebrates, like the lamprey," said Harris.

The researchers think that their work may provide some insight into their research on sudden infant death syndrome or SIDS.

Source: [University of Alaska Fairbanks](#)

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