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- Animals
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Lampreys Shed Light on Evolution of Air Breathing in Vertebrates

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(Photo : Reuters) A new study sheds light on the likely evolution of air breathing in vertebrates.

A new study sheds light on the likely evolution of air breathing in vertebrates.

Researchers from the University of Alaska, Fairbanks (UAF) have found that air breathing could have evolved from an ancient vertebrate which did not have a lung, but did have a rhythm generator - neural circuit that is sensitive to carbon dioxide.

"To breathe air with a lung, you need more than a lung, you need neural circuitry that is sensitive to carbon dioxide," Michael Harris, a UAF neuroscientist and lead researcher on a project investigating the mechanisms that generate and control breathing, said in a statement. "It's the neural circuitry that allows air-breathing organisms to take in oxygen, which cells need to convert food into energy, and expel the waste carbon dioxide resulting from that process.

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"I'm interested in where that carbon-dioxide-sensitive neural circuit, called a rhythm generator, came from," he said.

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The research team studied lampreys, jawless fish-like vertebrates that are similar to the first vertebrates. They don't have lungs and don't breathe air. These vertebrates stay in tubes dug into soft mud. They pump water through their bodies to breathe and feed.

When mud clogs the tube, the lampreys eject water using a cough-like behavior to clean the tube. A rhythm generator in the lamprey's brain controls the cough-like behavior. Researchers found that there was a resemblance between the "cough" behavior of lampreys and air breathing in amphibians.

They removed the lamprey's brain and measured the nerve activity that is linked to breathing. They noticed that the nerve circuit in the brain was sensitive to carbon dioxide.

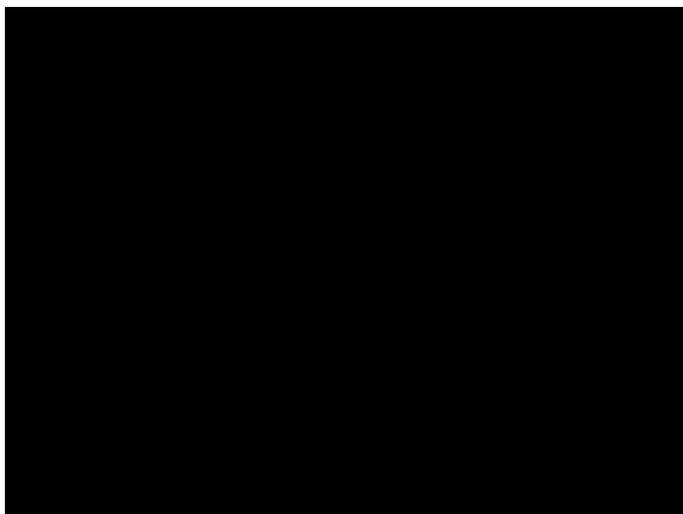
According to the researchers, lungs in mammals would not have worked as a lung without the rhythm generator. They pointed out that air breathing evolved in fish and allowed the vertebrates to move to land, and evolve into reptiles, birds and mammals.

"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.

Harris and his team hope that the study on origins of air breathing will shed light on Sudden Infant Death Syndrome (SIDS).

The paper will be presented at the 42nd annual meeting of the Society for Neuroscience Oct. 17 in New Orleans.

Take a look at the video clip recorded in Harris' lab showing the difference between gill ventilation and a "cough" in a larval lamprey. The "cough" occurs at about the 9 second mark.



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