

BREATHING IN THE BAYOU

Picture a swampy Louisiana bayou with alligators gliding through the water and egrets flying from spot to spot, finding a meal under the cypress trees covered in Spanish moss. The swamp is oddly quiet, with the movements of the wildlife giving life to the bayou. What if there is a common tie between the two common lifeforms found in that Louisiana bayou? Researchers have recently found that the lungs that allow that alligator in the Louisiana wetlands to survive in the water and the egret to fly are uniquely similar.

As you breathe in and out, air enters your body via your nose, travels down into the bottom of your lungs, and is exhaled after the oxygen has been absorbed. This process occurs differently in birds. Birds have a more efficient respiratory system adapted to unidirectional airflow, or, in other words, air moves in one direction through the bird's system like a circuit. As it turns out, alligators can breathe the same way.

It is well known that birds breathe in a different way than mammals do. What has been more difficult to determine is how alligators breathe. There had been some suggestion that alligators might breathe via unidirectional airflow, too. However, no one had conclusively illustrated that this was the case. To test the hypothesis, evolutionary biologists C. G. Farmer and Kent Sanders placed sensors in two parts of the respiratory passageways of four dead alligators, artificially ventilated the lungs, and observed how the air moved.

The results suggested that the airflow inside the alligator's body was capable of moving in a unidirectional manner, but would they breathe this way while alive? To find out, the scientists placed airflow measurement devices in six living alligators. They found that the airflow in the alligator's respiratory system continued through the transition between inspiration (new air coming in) and expiration (old air going out). Air kept on moving through the system during both phases, again suggesting that the alligators were breathing through unidirectional airflow.

Just how the alligators can do this is not yet understood. However, the discovery that they can breathe like birds might provide clues to some significant events in the history of life on earth. If living alligators and birds both share this physiological mechanism, then it is possible that the last common ancestor of dinosaurs and alligators was a unidirectional breather. If this is correct, unidirectional breathing evolved in the first archosaurs over 230 million years ago in the wake of the worst mass extinction in the history of this planet.

Up to 96% of the animals known to have lived in the seas and over 70% of those that lived on land went extinct 250 million years ago. Among the survivors were the earliest archosaurs (or their close ancestors). If they had unidirectional breathing, it might have given them an advantage. Unidirectional breathing is a more efficient way of obtaining oxygen from the air. If the Permian mass extinction was triggered by major changes in the atmosphere, such as the depletion of oxygen, the unidirectional lung system could have assisted in survival. Morphologist Adam Summers said, "The ability to force a lot of oxygen into the lungs [with unidirectional flow] meant that the animals suddenly were better adapted to the thinner air than were the mammal ancestors that were alive at the same time."

Researchers are excited about this recent discovery and believe it opens up a new world of evolutionary biology.

Adapted from:

Berardelli, P. (2017, December 10). Swim Like a Gator, Breathe Like a Bird. Retrieved March 2019, from <https://bit.ly/2TBXBOG>

Farmer, C. G., & Sanders, K. (2010). Unidirectional Airflow in the Lungs of Alligators. *Science*, 327(5963), 338–340. <https://doi.org/10.1126/science.1180219>

Switek, B. (2010, January 20). New Study Suggests Alligators Breathe Like Birds. Retrieved March 2019, from <https://bit.ly/3gmy068>

