

Crocodiles rock the treadmill for research

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Crocodiles have been put through their paces on a treadmill as part of a James Cook University research project to help determine which muscles they use to breathe.

Led by the Townsville-based Dr Suzy Munns, the research was conducted on five young estuarine crocodiles to test the role of the diaphragmaticus muscle, also known as the 'hepatic piston pump'.

The muscle is a thin translucent muscle that produces piston-like movements, thought to be used for breathing in the animal.

A series of tests were performed to measure breathing, metabolic rate and the amount of oxygen and carbon dioxide in the blood under different conditions such as altered temperature, increasing carbon dioxide and [treadmill](#) exercise.

The contribution of the hepatic piston pump was determined by repeating the tests in crocodiles with disabled pumps.

The research team was made up of an international group of scientists; Dr Tomasz Owerkowics from the University of California, San Bernadino, Dr Sarah Andrewartha from the University of North Texas and Professor Peter Frappell from the University of Tasmania.

The scientists had the task of exercising crocodiles weighing approximately 1.5kg on a modified human treadmill.

Dr Munns, a senior lecturer in Physiology and Pharmacology at JCU and the project's chief researcher, said despite the 'classic' knowledge of the hepatic piston pump being the main breathing mechanism in crocodiles, their research showed the muscles of the rib cage were the primary muscles used to inflate the lungs.

"Our study has shown that the hepatic piston pump is not essential for breathing," she said.

"The diaphragmaticus [muscle](#), which powers the hepatic piston pump, is unique to crocodilians and was thought to enable crocodiles to draw air into their lungs in a very different way to the rest of the reptiles and other vertebrates, but our data shows that crocodiles inflate their lungs just like most other animals," Dr Munns said.

She said that while the hepatic piston pump helps with [breathing](#) during exercise, one theory was that it may also be used to control pitch and rolling movements during diving.

"This study highlights that knowledge is provisional and that theories need to be challenged in order for our understanding to grow."

Dr Munns said she hoped the research would help change the way comparative respiratory physiology was taught.

"[Crocodiles](#) are the largest living reptile and provide us with important insights into the way dinosaurs may have breathed," she said.

"If we don't understand the very basic mechanisms of how a crocodile breathes, then trying to understand their very unique cardiac structure or any of their other physiology will be flawed."

Provided by James Cook University

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