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Turtles and technology advance understanding of lung abnormality

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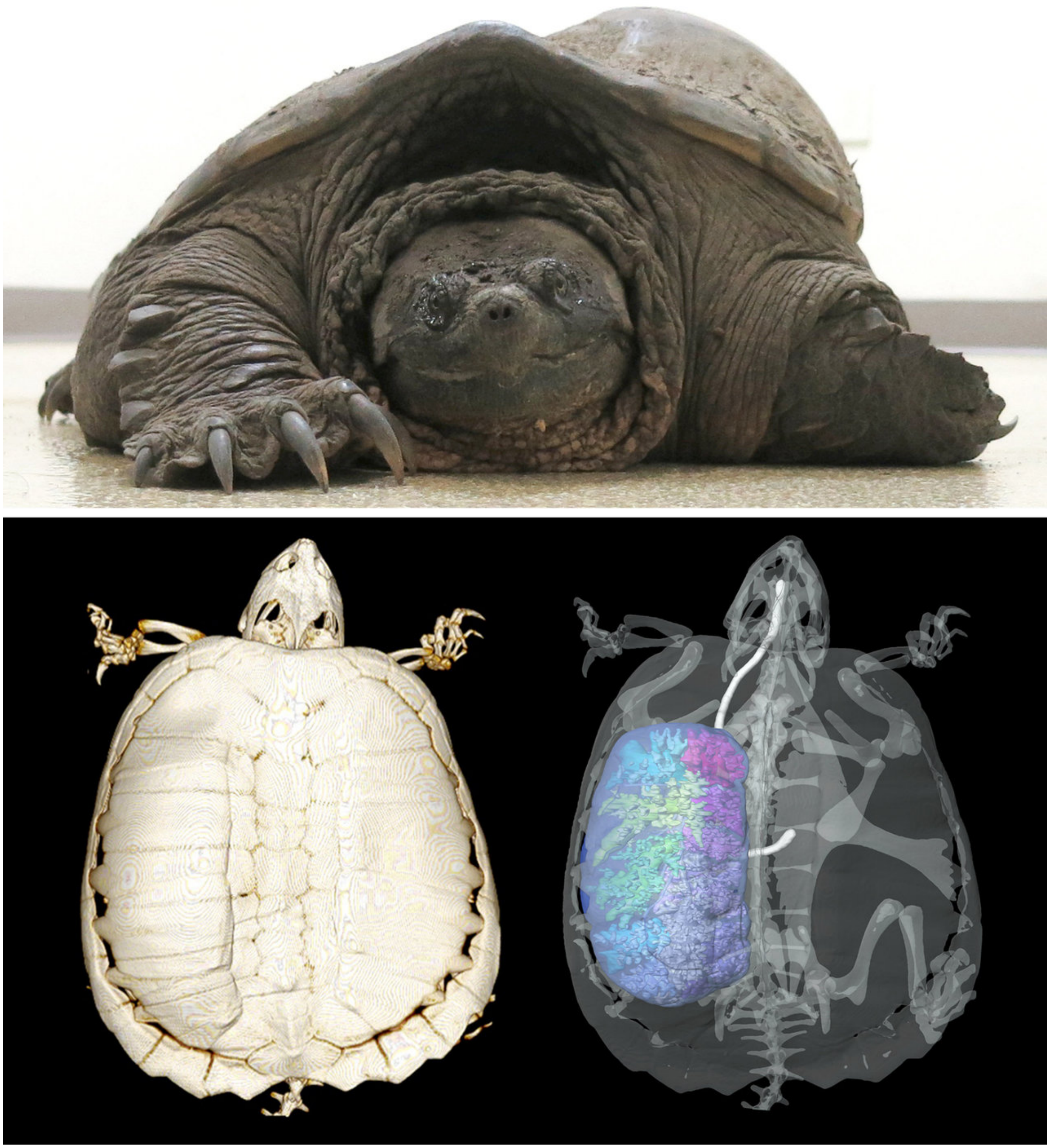

Live turtle and 3-D model. Credit: LSU Health New Orleans

A study of an unusual snapping turtle with one lung found shared characteristics with humans born with one lung who survive beyond infancy. Digital 3D anatomical models created by Emma Schachner, PhD, Assistant Professor of Cell Biology & Anatomy at LSU Health New Orleans School of Medicine, made the detailed research possible. The work is published in the December 2017 issue of *The Journal of Anatomy*, the cover of which features an image of the study's 3D models.

"These shared traits include an enlarged single lung with a more homogenous distribution of respiratory parenchyma (the gas exchanging tissues), an opposing bronchus that ends where the opposite lung should be and malformations of the spine (such as scoliosis)," notes Dr. Schachner. "It is possible that similar genetic mutations are at play in both this turtle and in humans with this condition."

The turtle was found in Minnesota and brought to the Wildlife Rehabilitation Center of Minnesota because of a bizarre shell deformity. When the single lung was discovered, Senior Veterinarian Renee Schott, DVM, contacted Schachner and co-author Dr. Tyler Lyson through their previous work on turtle lungs. Although the common snapping turtle has been well-studied, very little is known about developmental abnormalities and soft tissue pathologies of turtles and other reptiles.

Using computed tomography (CT) and microCT imaging data and a pen tablet with special software, Schachner manually created 3D digital models of the areas of interest in both the live turtle and normal turtle specimens for comparison. She created solid 3D representations of the negative spaces within the lungs - the bronchial tree, the lung surface and the skeleton.

"This allowed us to compare the architecture of the branching patterns inside the lung and the position of the lungs relative to the shell in the pathological turtle with those of the normal turtles," Schachner explains.

"These types of models facilitate visualization of specific anatomical structures that are extremely difficult to see in living animals, like blood vessels and air spaces, and allow us to make qualitative and quantitative comparisons between animals without hurting or destroying the specimens."

Findings include that the primary difference between the internal pulmonary structure of the pathological individual and that of a normal adult is a marked increase in the surface area and density of the gas-exchanging tissue originating from the secondary airways, a 14.3% increase in the surface area to volume ratio. The researchers report that the abnormality has not had an impact upon the ability of the turtle to survive; however, it did interfere with aquatic locomotion and buoyancy control under water.

This turtle represents a striking example of a non-fatal congenital defect and compensation for it. The increased understanding of the relevant soft tissue structures revealed by the use of the model Schachner created for this study and others like it may one day translate to improved diagnoses in both animals and humans.

More information: E. R. Schachner et al, Pulmonary anatomy and a case of unilateral aplasia in a common snapping turtle (Chelydra serpentina): developmental perspectives on cryptodiran lungs, *Journal of Anatomy* (2017). DOI: 10.1111/joa.12722

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