US scientists say fossilized heart indicates dinosaurs may have been warm-blooded

Walter Gilberti
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In a remarkable discovery, paleontologists at North Carolina State University and the North Carolina Museum of Natural Sciences have discovered and examined the fossilized heart of a 66 million-year-old dinosaur. Their findings suggest that dinosaurs were probably endothermic (warm-blooded), as opposed to modern reptiles which are exothermic (cold-blooded).

The dinosaur, a species of Thescelosaur, a late Cretaceous herbivore, had been discovered in 1993, on a ranch in South Dakota, an area rich in fossil dinosaurs. Nicknamed Willo, after the wife of the rancher, the nearly complete skeleton, imbedded in sandstone, was removed in tact, and later acquired by the museum. At the time of it's discovery, scientists believed that a mass of fossilized material within the crushed chest cavity might reveal the remains of soft tissue. Fossilized tendons and cartilage were in evidence, making this find truly unique.

Once at the university, the fossil was subjected to several tests including a CT scan, a form of medical x-ray. The scan revealed a two-dimensional image which was then enhanced by computer software that resulted in a three-dimensional model. This enabled scientists to actually distinguish the various heart chambers and the aorta. The researchers published their findings, which appear in the April 21 issue of the journal, Science.

According to Dr. Dale Russell, an NC State paleontologist and a senior research curator at the museum, “Not only does this specimen have a heart, but computer-enhanced images of its chest strongly suggest it is a four-chambered, double pump heart with a single systemic aorta, more like the heart of a mammal or bird than a reptile.”

In another test, Dr. Reese Barrick, an NC State paleobiologist conducted an x-ray diffusion analysis that showed the presence of iron in the fossilized mass, but not in the surrounding sandstone, thus further corroborating the CT scan analysis.

According to Dr. Michael Stoskopf, who along with Russell, and Paul Fischer, director of the Biomedical Imaging resource facility, co-authored the findings, the dinosaur enjoyed a complete separation of oxygenated and non-oxygenated blood. “Willo's ventricles and aorta indicate it had completely separate pulmonary and body circulatory systems, which suggests it had a metabolic rate higher than we generally see in living reptiles.”

Paleontologists have long suspected that dinosaurs may have been endothermic. Their skeletal structure, highlighted by legs placed under the body and the large number of bipedal (two-legged) species - as well as their great size, meant they must have had a powerful and highly efficient cardiovascular system at their disposal.

In order to maximize activity on land, vertebrates have evolved a circulatory system to deal with the problem of distributing oxygen to the trillions of cells in their bodies, as well as the related problem of maintaining body temperature. Mammals and birds, which are also endothermic, do this best, but their is ample evidence that dinosaurs were also extremely active. Thescelosaur, which lived near the end of the reign of the dinosaurs, shows evidence that it was highly evolved.

Of particular note is the discovery that Willo had a single aorta. “The single aorta is really important,” explained Dr. Russell. “This challenges some of the most fundamental theories about how and when dinosaurs evolved.” Russell points out that while modern crocodiles are the only living reptiles with four-chambered hearts (living lizards and snakes have 3-chambered hearts), there is still some mixing of blood

due to crocodiles having double arteries, rather than a single aorta, found in birds and mammals, that transports oxygenated blood from the left ventricle throughout the body.

Finding fossilized soft tissue, let alone something as scientifically valuable as a dinosaur's heart, is extremely rare. Russell attributes it's fossilization to saponification, a process whereby soft tissues are submerged in a wet oxygen free environment, that allows them to petrify rather than decay.