AMERICAN MUSEUM ŏ NATURAL HISTORY

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SKULLS OF RED AND GIANT PANDAS PROVIDE INSIGHT INTO COEXISTENCE

BITING SIMULATIONS SHOW KEY DIFFERENCES IN PANDA SKULLS, LINK TO DIETARY PREFERENCES

New research on the skulls of red pandas and giant pandas provides further explanation as to why the two species—which are not closely related but dine on the same food, bamboo, in the same geographic area—are able to coexist. Using high-resolution imaging and biting simulations, scientists at the American Museum of Natural History and the University of Málaga in Spain found that the skulls of the two panda species not only are distantly related but also have structural differences related to the way the animals chew. These substantial differences reflect distinct bamboo feeding preferences, with red pandas foraging on softer parts of the plant and giant pandas seeking out the tougher stems. The findings are published in the journal *Biology Letters*.

"Scientists have been studying the differences between red pandas and giant pandas for a long time because there's a basic principle in ecology that says if two species of an organism utilize the same resources, they cannot live in the same space. There's too much competition," said Z. Jack Tseng, a Frick Postdoctoral Fellow in the Museum's Division of Paleontology and the corresponding author on the new study. "This research contributes to the body of work showing how the pandas co-exist. We've found that fundamentally, based on the structure of their skulls, they cannot eat the same things."

The red (*Ailurus fulgens*) and giant (*Ailuropoda melanoleuca*) pandas are mammalian carnivores separated from each other by about 40 million years of evolution. The red panda is most closely related to animals like raccoons and weasels and weighs about 10 pounds. The giant panda is a member of the bear family, and it is much larger, weighing about 220 pounds. Their geographic ranges overlap in southern China, and both animals have

independently adapted to a diet consisting mainly of the same bamboo species.

The researchers used x-ray computed tomography (CT) to create high-resolution, three-dimensional models of the pandas' skulls and teeth. Based on these data, they built a series of computer-generated biting simulations to study the skulls' biomechanics. They found that although the skulls have some broad similarities—they both are robust and versatile and can accommodate a wide variety of chewing—there are some distinct differences.

The skull of the red panda is better at distributing mechanical stress during chewing than the skull of the giant panda. But the giant panda has a stronger skull that can withstand greater forces that are more concentrated and could be more damaging, even after accounting for the size differences between the two species.

"These differences tie into the way that the species actually process bamboo," Tseng said. "The giant panda is a less-refined eater: it does a lot of chomping and swallowing. Their skulls are stronger overall, so the peak biting stresses are lower, meaning that they can eat harder and larger pieces of bamboo. The red panda has a weaker skull but it's better at distributing stresses, allowing it to chew longer and break down soft bamboo leaves more thoroughly before they swallow them."

These links between dietary preference and skull performance provide an engineering basis for explaining how the co-existence of the two panda species is possible, the authors say.

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Other authors include Borja Figueirido, Francisco J. Serrano-Alarcón, Alberto Martón-Serra, and Juan F. Pastor, all from the University of Málaga.

Scientific paper (subscription required):
http://rsbl.royalsocietypublishing.org/content/10/4/20140196.full

Biting simulations of the red panda and giant panda skulls can be viewed at:
https://www.youtube.com/watch?v=P7sKhJHI4Ag

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The American Museum of Natural History, founded in 1869, is one of the world's preeminent scientific, educational, and cultural institutions. The Museum encompasses 45 permanent exhibition halls, including the Rose Center for Earth and Space and the Hayden Planetarium, as well as galleries for temporary exhibitions. It is home to the Theodore Roosevelt Memorial, New York State's official memorial to its 33rd governor and the nation's 26th president, and a tribute to Roosevelt's enduring legacy of conservation. The Museum's five active research divisions and three cross-disciplinary centers support 200 scientists, whose work draws on a world-class permanent collection of more than 32 million specimens and artifacts, as well as specialized collections for frozen tissue and genomic and astrophysical data, and one of the largest natural history libraries in the world. Through its Richard Gilder Graduate School, it is the only American museum authorized to grant the Ph.D. degree. In 2012, the Museum began offering a pilot Master of Arts in Teaching program with a specialization in Earth science. Approximately 5 million visitors from around the world came to the Museum last year, and its exhibitions and Space Shows can be seen in venues on five continents. The Museum's website and collection of apps for mobile devices extend its collections, exhibitions, and educational programs to millions more beyond its walls. Visit amnh.org for more information.

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