

Woodpeckers' Cranial Bone Structures Help the Bird Avoid Injury and May Help Development of Human Headgear

By *Anna Sanders*
Created 04/11/2012 - 4:20pm



Woodpeckers, like this great spotted female above, avoid head injury during pecking because of their cranial microstructures, a new study says. (Photo: [David Smith](#) ^[1]/[CC-by-2.0](#) ^[2])

Tap, tap, tap. Woodpeckers will repeatedly drum their beaks into dead or decaying tree trunks while building nests or searching for food and, to the casual observer, this incessant pecking might seem a little reckless. But evolution has afforded woodpeckers some safeguards. While scientists have predicted ^[3] the birds avoid injury through large brain cases, strong muscles, and special feathers covering their nostrils to protect them from flying debris, researchers in China have found ^[4] that the woodpecker's macro/micro morphology has also plays a role in resisting head impact injury. The research could mean more effective protective gear for humans exposed at risk for head injury.

Through a comparative study of the mechanical properties, microstructure, and composition of the cranial bone and beak of great spotted woodpeckers, scientists found that the bird's special hyoid bone, unequal beak, and uneven spongy bone help avoid head trauma.

“These distinctive mechanical properties, microstructure and composition of woodpecker's cranial bone and beak provide an excellent resistance to head impact injury at a high speed and deceleration,” explains study co-author Lizhen Wang. The great spotted woodpecker, Wang says, is able to avoid head injury pecking at a high frequency, velocities of 6-7 m/s, and an acceleration of 1000 times that of gravity. In comparison, humans are most likely to avoid injury at accelerations below 18 times that of gravity [5], though U.S. Air Force officer John Paul Stapp [6] survived an acceleration of 46.2 g.

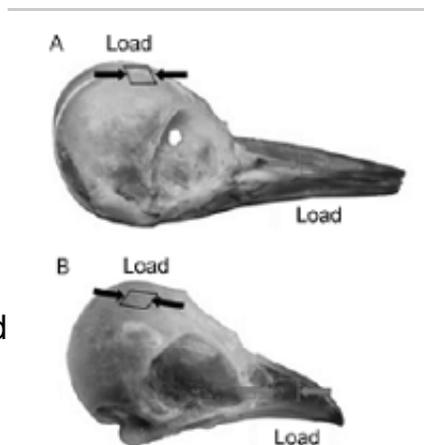
Wang and fellow researchers compared the great spotted woodpecker's bone structure to that of the lark. They found that the woodpecker's cranial bone is more equipped to resist impact injury because of its microstructure. Compared to the lark, the woodpecker has a more plate-like trabecular bone, a greater number of thicker and more closely spaced trabeculae, and higher proportion of bone mineral.

The study is the result of three years of research by Fan Yubo and colleagues, including Wang, at the Key Laboratory for Biomechanics and Mechanobiology of the Ministry of Education, Beihang University's School of Biological Science and Medical Engineering, and Wuhan University of Technology's School of Materials Science and Engineering. Their findings were released April 10 and were published last November [7] in *SCIENCE CHINA Life Sciences*. While other research on woodpeckers has analyzed the bird qualitatively, the new work is more quantitative, says Wang.

“Our work has studied the kinematics, load transmission, pecking force, micro-structure of cranial bone, beak quantitatively,” explains Wang.

Their research may also “inspire the design and optimization of protective headgear for humans,” concludes the study's authors.

“Head injuries remain as an increasingly common cause of death and severe disabilities around the world,” says Wang. “Yet, the woodpecker has no head injury under the condition of 1000g.”



Researchers compared the skulls of the great spotted woodpecker (A) and lark (B) to determine how woodpeckers resist head injury. (© SCIENCE CHINA Press)

[Animals](#) [Birds](#) [Health](#) [Nature](#)

//> //>

```
var gaJsHost = (("https:" == document.location.protocol) ? "https://ssl." : "http://www.");
document.write(unescape("%3Cscript src=" + gaJsHost + "google-analytics.com/ga.js'
type='text/javascript'%3E%3C/script%3E")); var pageTracker = _gat._getTracker("UA-
6149536-1"); pageTracker._trackPageview();
```

Source URL: <http://magblog.audubon.org/woodpeckers%E2%80%99cranial-bone-structures-help-bird-avoid-injury-and-may-help-development-human-headgear>

Links:

- [1] http://www.flickr.com/photos/david_e_smith/2572907688/
- [2] http://commons.wikimedia.org/wiki/File:Dendrocopos_major_-Finland_-female_by_nest-8.jpg
- [3] <http://archive.audubonmagazine.org/books/editorchoice0703.html>
- [4] http://www.eurekalert.org/pub_releases/2012-04/sicp-mpa040612.php
- [5] <ftp://ftp.rta.nato.int/PubFullText/RTO/EN/RTO-EN-HFM-113/EN-HFM-113-06.pdf>
- [6] <http://www.ejectionsite.com/stapp.htm>
- [7] <http://life.scichina.com:8082/sciCe/EN/article/searchArticle.do>