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News

Genome reveals panda's carnivorous side

Bamboo-eater seemingly has no genes for cellulose-digesting enzymes.

Jane Qiu



Jingjing, the three-year-old female panda whose genome has been sequenced. *Zhihe Zhang*

The complete genetic sequence of the giant panda has revealed that the iconic Chinese bear has all the genes required to digest meat — but not its staple food, bamboo.

The international team sequenced a three-year-old female panda called Jingjing, who was also a mascot of the 2008 Beijing Olympics, and found that she lacks any recognizable genes for cellulases — enzymes that break down the plant material cellulose. "The panda's bamboo diet may be dictated by its gut bacteria rather than by its own genetic composition," says Wang Jun, deputy director of the Beijing Genomics Institute in Shenzhen, Guangdong province, who led the sequencing project.

The researchers also discovered that the *T1R1* gene, which encodes a key receptor for the savoury or 'umami' flavour of meat, has become an inactive 'pseudogene' due to two mutations. "This may explain why the panda diet is primarily herbivorous even though it is classified as a carnivore," says Wang.

The research, published in *Nature*¹, shows that pandas have about 21,000 genes packed into 21 pairs of chromosomes, including one pair of sex chromosomes. Of all the mammals that have been sequenced, pandas are most similar to dogs — with 80% similarity — and are only 68% similar to humans.

But the bear's genome has undergone fewer genetic changes over time than those of dogs and humans, suggesting that it evolved more slowly.

The panda is often regarded as a 'living fossil' because its ancestors are thought to have lived in China more than eight million years ago.

The study also shows pandas have a high degree of genetic diversity — about twice as much as humans. "This shows that the panda has a good chance of survival despite its small population size," says Wang.

"The study has laid the biological foundation to better understand pandas, and has the potential for improving conservation by controlling diseases and boosting reproduction of the species," says Jianguo Liu, a conservation biologist at Michigan State University in East Lansing, Missouri, who was not involved in the study.

Habitat threat

But critics stress that protecting the panda's increasingly fragmented and shrinking habitat is a more pressing issue in their conservation. China is thought to be home to around 1,600 wild pandas — though the actual number is hotly debated. Another 300 or so live in captivity.

Some conservationists, such as Fan Zhiyong, director of the conservation group WWF's China species programme, believe that the panda genome will have little impact on conservation efforts. "Protecting pandas in the wild remains the top priority, but their habitats are becoming smaller and smaller," says Fan. "If we don't have any wild pandas one day, what can we do with their genes?"

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[Although China has set up several panda sanctuaries since the 1960s, economic development often takes precedence over conservation. Consequently, pandas' habitats are often invaded by construction projects such as dams and highways. Tourism is also a big threat because pandas are reclusive creatures. For example, Jiuzhaigou, a panda sanctuary in Sichuan, is visited by millions of tourists every year. "You don't see any pandas there anymore," says Fan. "This is hardly surprising."](#)

[There is "no doubt" that information from the genome and habitat protection are both crucial for conservation efforts, says Wang. The panda genome, the first in a string of sequencing efforts by the Shenzhen institute, will be a test of how such genetic information can help in the conservation of endangered species, he adds. The team has got a draft genome map of the polar bear, and has started sequencing the genome of the Tibetan antelope.](#)

References

1. Li, R. *et al. Nature* doi:10.1038/nature08696 (2009).

Comments

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#9083

This is unexpectedly great news for Creationists! You see, one of the logically hard to accept topic in the Book of GENESIS is the allegation that all animals lived in peace in the Garden of Eden before the Fall (presumably wolves and sheep being all vegetarians), and that they separated into meat-eating predators and prey after the Fall and on account of the Fall. Today, hard science reveals in the case of Giant Panda that this apparent "absurdity" might not be an absurdity after all, and that this proposition merits more thought and respect. What do you say, Richard?

- o [Report this comment](#)
- o 2009-12-14 09:32:51 AM
- o Posted by: Triantafillos Eleftheriou

#9086

Mr./Ms. Eleftheriou, I do not understand your argument: cherry-picking information isn't very useful. It is hard to reconcile a world-is-8000-year-old view with loss-of-function mutations that predate this theory on a time scale.

On the contrary, this is EXACTLY what evolution is about. Perhaps a mutation inactivated a gene, but gut microbiota allowed the panda bear to break down cellulose. Had that not been the case, we might not have had any panda bears at all!

- o [Report this comment](#)
- o 2009-12-14 11:48:39 AM
- o Posted by: A Mahapatra

#9087

Apologize for the mistype above. A panda, of course, is not a "bear".

- o [Report this comment](#)
- o 2009-12-14 11:49:51 AM
- o Posted by: A Mahapatra

#9088

I believe this particular scientific discovery suggests Pandas were carnivorous meat eaters while living in the garden, but only started eating plants **after** being shunned from the garden; as punishment for their cruel flesh-eating ways, God mutated their Umami taste buds to deny them the pleasure of tasting the savory flavors of fresh meat... and so they became vegetarians.

- o [Report this comment](#)
- o 2009-12-14 01:04:02 PM
- o Posted by: Alex Cranson

#9089

To Mahapatra: No need for apologies. The Giant Panda does belong to the bear family. It says so in the article too.

- o [Report this comment](#)
- o 2009-12-14 01:14:07 PM
- o Posted by: H T

#9090

Michigan State University is in East Lansing, Michigan, not Missouri as stated in the article. Minor point but needed clarification.

- o [Report this comment](#)
- o 2009-12-14 02:00:31 PM
- o Posted by: Ted Hitchcock

#9091

Which are the nonfungi which has cellulase?

- o [Report this comment](#)
- o 2009-12-14 04:02:32 PM
- o Posted by: Joby Joseph

#9092

Bacillus subtilis has it. I guess it shows that panda's are neither bacteria nor fungi. Well done!

- o [Report this comment](#)
- o 2009-12-14 05:20:39 PM
- o Posted by: Bram van Raam

#9093

Bram van.. exactly the point. I am still searching for some higher organism which has it. Wiki says some are there but do not name any. But I doubt it.

- o [Report this comment](#)
- o 2009-12-14 06:09:37 PM
- o Posted by: Joby Joseph

#9094

Bos taurus doesn't. I guess that's also a secret carnivore. It is for sure that bovines use their gut bacteria to digest grass. Not very surprising if pandas do so as well for bamboo.

- o [Report this comment](#)
- o 2009-12-14 06:27:34 PM
- o Posted by: Bram van Raam

#9095

It is more likely that Pandas are Buddhists, and if religion has anything to do with it, they are evolving spiritually toward being vegetarians. That being, of course, a somewhat silly debate, there are serious issues at hand.

As noted in the article, the panda may not survive in the wild, despite the intense and loving efforts of scientists worldwide. Nonetheless, even if the species only lives in protected habitats and conservation centers like zoos, it will have a useful purpose. The pandas' emotional appeal is almost unequalled. Their general charm and the loving, sometimes human-looking, relationship between the cub and the mother rally people to the cause of preservation. Children who are fascinated by them learn to care about ecology and the problems of habitat destruction. Despite the cost of having them in centers outside China, the pandas bring income to the zoos and all preservation research because of their emotional appeal.

No species should disappear, but there is in the panda a great "spokespecies" for all (including humans) who are threatened.

- o [Report this comment](#)
- o 2009-12-14 07:59:46 PM
- o Posted by: Patricia Simon

#9116

Having started this line of comments, please allow me to add a few more words on the subject. Every interesting scientific finding is bound to have an impact on our philosophic – religious thinking. After all, isn't this kind of impact the greatest result of Darwin's work? Now, our scientists inform us that a lovely black and white creature – although genetically programmed to be carnivorous – behaves and acts as vegetarian. The evolutionist explains that this apparent "dietary perversity" is due to mutations (with a little help from the action of gut microbiota) and sees the case as clarified. The creationist remains loyal to the Book. All animals were vegetarian in the Garden. After the Fall, each animal started a long process of adaptation in line with its genetic program. This process took quite some time and lasted even after the Deluge (there was no blood-shedding within the Arc). Then everything became normal in the animal world. The giant Panda is still in the process of adaptation. No mutations are responsible for its present day vegetarian habits. This animal proceeds at a very leisurely pace to become what it has to be: a flesh eating animal. Look, our scientists clearly point out that the Panda's genome has undergone few genetic changes over time, suggesting that it evolved slowly. This serene lazy bones is a living fossil mirroring the behavior of animals in the pre-Fall situation. Eh, Richard?

- o [Report this comment](#)
- o 2009-12-16 07:37:33 PM
- o Posted by: Triantafillos Eleftheriou

#9175

I loved your comments specially those of Patricia; But apart from the fact that Pandas may be buddhist, I was wondering whether any attempts have been made to clone this lovable bear?

- o [Report this comment](#)
- o 2009-12-22 04:00:30 PM
- o Posted by: Nishal Issur

#9219

Conservation success depends on its habitat area and awareness of its importance scientist should link conservation plans and genetics brake through with ethics to make people to consider panda as scared animal like monkey which is considered as form of god so today in india there is no need to set any conservation plan for monkey conservation as it is considered as scared.

- o [Report this comment](#)
- o 2010-01-05 09:18:12 AM
- o Posted by: Ranjeet Singh Mahla Mahla

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