

The Ruminant Genome Project reveals the secret lives of deer

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Three teams of researchers working independently have conducted three specific studies of ruminants—a class of mammals that obtains nutrients from plants by fermenting it in chambered stomachs. The work was part

of an overall project called, quite naturally, the Ruminant Genome Project. All three teams were made up of members from several institutions in China and a few other countries. All three groups have published their findings in the journal *Science*. Also, Dai Fei Elmer Ker and Yunzhi Peter Yang with the Chinese University of Hong Kong and Stanford University, respectively, have published a [Perspective piece](#) outlining the work by the three teams in the same journal issue.

Domesticated ruminants such as sheep and cows are important to humans. Others are important because of their unique physical characteristics. Deer antlers, for example, grow exceptionally quickly, and reindeer live in the Arctic without freezing or suffering depression due to long winter nights. In this new effort, all three teams sought to learn more about particular aspects of these unique mammals.

In the first study, the researchers assembled the genomes of 44 ruminants covering all six members of the Ruminantia families. They created a [phylogenetic tree](#) for the group, which helped to clear up some of the mysteries in the family history. It also showed that the group as a whole suffered severe declines in population coinciding with humans migrating out of Africa.

The work by the second team involved studying ruminant headgear—[horns](#), antlers, pronghorns and ossicones. They found that despite their physical differences, the bony headgear shared many similarities. They also found that the reason deer antlers regenerate so quickly is because they exploit cancer-associated signaling paths. The deer also have tumor-suppressing genes that prevent tumors from growing in their antlers—information that could be useful in cancer research.

The third team focused most specifically on reindeer—they wanted to know how the deer manage to survive in such a cold, harsh environment,

and why they do not succumb to depression during long, dark winters. To find out, they studied the reindeer genome and discovered that [reindeer](#) have unique genes related to metabolizing vitamin D and circadian arrhythmicity, and also for female [antler](#) growth. And their unique digestive system helps them survive on limited plant growth.

More information: Lei Chen et al. Large-scale ruminant genome sequencing provides insights into their evolution and distinct traits, *Science* (2019). [DOI: 10.1126/science.aav6202](https://doi.org/10.1126/science.aav6202)

Yu Wang et al. Genetic basis of ruminant headgear and rapid antler regeneration, *Science* (2019). [DOI: 10.1126/science.aav6335](https://doi.org/10.1126/science.aav6335)

Zeshan Lin et al. Biological adaptations in the Arctic cervid, the reindeer (*Rangifer tarandus*), *Science* (2019). [DOI: 10.1126/science.aav6312](https://doi.org/10.1126/science.aav6312)

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