Polar Bears: Flabby and Fabulous

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by Molly Michelson

“For polar bears, profound obesity is a benign state,” says UC Berkeley’s Eline Lorenzen.

Lorenzen and her colleagues report on polar bear evolution and their ability to live on high-fat diets in the recent edition of the journal *Cell*. The international team compared the genomes of polar bears and brown bears (including grizzlies) and discovered some surprising results.

Science Today has reported twice on the origin and age of polar bears (here and here) with two separate studies putting the Arctic bears’ beginnings at 600,000 and 4-5 million years ago, respectively. The new *Cell* study adds further controversy, putting polar bear divergence from brown bears more recently — 343,000–479,000 years ago.

According to Lorenzen, the “key that allowed us to unlock the door of polar bear evolution” was a method devised by UC Berkeley mathematics graduate student Kelley Harris that has been used to estimate human demographic history. The approach, referred to as the identity by state (IBS) tract method, has proved powerful in estimating when ancient human populations diverged, their past population sizes, and when and how much they interbred.

The other surprise in the comparative genomic study of polar bears is the speed of evolution in the genome of polar bears once they diverged from brown bears and adapted to the Arctic marine environment with food sources particularly high in fat. The study reveals that over several hundred thousand years, natural selection drove major changes in genes related to white fur, cardiovascular function, as well as fat transport in the blood and fatty acid metabolism. Fat comprises up to half the weight of polar bears living today.

“The life of a polar bear revolves around fat,” Lorenzen says. “Nursing cubs rely on milk that can be up to 30 percent fat and adults eat primarily blubber of marine mammal prey. Polar bears have large fat deposits under their skin, and because they essentially live in a polar desert and don’t have access to fresh water for most of the year, [they] rely on metabolic water, which is a byproduct of the breakdown of fat.”

The genes pinpointed by the study may explain the bear’s ability to cope with a high-fat diet while avoiding fatty plaques in their arteries and the cardiovascular diseases that afflict humans with diets rich in fat. These genes could provide insights into how to protect humans from the ill effects of a high-fat diet.

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