

At high altitude, carbs are the fuel of choice

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This is a photo of an Andean mouse. Credit: Schippers et al., *Current Biology*

Mice living in the high-altitude, oxygen-starved environment of the Andean mountains survive those harsh conditions by fueling their muscles with carbohydrates. The findings, reported online on December 6 in *Current Biology*, a Cell Press publication, provide the first compelling evidence of a clear difference in energy metabolism between high- and low-altitude native mammals.

"The high-altitude mice we examined in this study are a rare exception to a general exercise fuel use pattern seen in lowland mammals," said Marie-Pierre Schippers of McMaster University. "Studying exceptions to a rule is often the key to uncovering the mechanisms of a physiological process."

The new study conducted with collaborators from the Universidad Peruana Cayetano Heredia in Peru could therefore lead to increased understanding not only of mountain-dwelling mice but also of other mammals, including humans, said Grant McClelland, also of McMaster University.

At an altitude of roughly 4,000 meters, every

breath of air contains about 40 percent less oxygen than it would at sea level. Under those conditions, carbohydrates are the logical energy source. That's because carbs can supply 15 percent more energy for the same amount of oxygen in comparison to fats.

In fact, the idea that high-altitude environments should favor [carbohydrate metabolism](#) was proposed almost 30 years ago, but it hadn't really been put to the test. In the new study, the researchers used a powerful multispecies approach, using four [native species](#) of mice, two from the [Peruvian Andes](#) and two found at sea level.

The researchers found that the high-altitude mice do indeed burn more carbohydrates. Their heart muscles show greater oxidative capacity, too, both adaptations that would afford the animals the ability to remain active at altitude more successfully than their lowland relatives could.

Those differences aren't a matter of adjusting to high versus low altitude but are rather due to inherent differences in the mice that have apparently arisen more than once over the course of evolutionary time.

"This is one of 'nature's solutions' to low atmospheric oxygen," McClelland said. "Our study shows that Andean mouse species have independently evolved a metabolic strategy that maximizes energy yield when little oxygen is available. It is possible that a similar strategy has also evolved in other high-altitude mammals, including humans."

More information: Schippers et al.: "Increase in Carbohydrate Utilization in High-Altitude Andean Mice." DOI: [10.1016/j.cub.2012.10.043](https://doi.org/10.1016/j.cub.2012.10.043)

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