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BLACK BEAR HIBERNATION MYSTERY

Bears can slow their metabolic rates far more than their body temperatures would predict.

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THE GIST

- During hibernation, black bears spend five to seven months without eating, drinking or taking a single bathroom break.
- Researchers monitoring black bears during hibernation can't completely explain how the black bears are able to drop their metabolisms.

Don't judge a bear by its temperature, or so suggests first-of-its-kind data on hibernation physiology.

There's something as-yet-unknown going on with black bear hibernation that slows metabolic rates more than lower body temperatures alone can explain, reports ecological physiologist Øivind Tøien of the University of Alaska Fairbanks.

In the depths of Alaskan winters, closely monitored black bears dropped their temperatures only a modest 5.5 degrees Celsius (9.9 degrees Fahrenheit) on average, Tøien and his colleagues report in the Feb. 18 *Science*. A standard physiologist's calculation predicts that such a chill would slow metabolism to 65 percent of nonhibernating resting rates. But the bears' metabolisms plunged down to even more energy-saving zones, averaging only 25 percent of the basic summer rate.

This sustained, big disconnect hasn't shown up so far in research on any other hibernating mammal, says study coauthor Brian M. Barnes, also of UA Fairbanks.

Mammal hibernation matters to human medical research, says physiological ecologist Hank Harlow of the University of Wyoming in Laramie. Relying on mechanisms that scientists would love to understand, black bears spend five to seven months without eating, drinking or taking a single bathroom break. But unlike bedridden or spacefaring people, the hibernators don't lose their muscle strength or bone mass. "Bears are just remarkable," Harlow says.

This Alaska study is the first to manage continuous monitoring of metabolic rate and body temperature throughout bear hibernation in low-disturbance conditions, Tøien says. Other studies based on intermittent sampling with older instruments, indirect evidence or studying bears with lots of people nearby have left the matter "uncertain," as he puts it.

He and his colleagues get such abundant data by volunteering to take in black bears that have developed a taste for foraging close to people and are about to be killed as menaces. "We read about them in the Anchorage Daily News before we get them," Tøien says.

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For their hibernation studies, the researchers monitored five bears, setting the animals up in wooden den boxes in an enclosure deep in the woods. The boxes were rigged to allow a bear to break out anytime it wanted. But while bears were inside, researchers checked the oxygen concentration to track metabolic rate. Instruments also measured muscle movements and heart function.

One bear's temperature did not drop much during early hibernation -- until she gave birth to a cub. The cub did not survive, and the female's temperature afterward behaved more like that of the other bears.

Reports of respectable drops in bear metabolic rates during hibernation cheer Eric Hellgren of Southern Illinois University Carbondale, who admits to "a biased viewpoint as a bear biologist." He says the Alaska study may lay to rest some of the long-running discussions from physiologists who treat bear hibernation as "a different and 'lesser' form" compared with the big metabolic shifts seen in small animals such as ground squirrels.

The detailed monitoring also revealed other bear quirks, such as the cycles of a few days or a week during midhibernation when bears temporarily shiver themselves up several degrees in body temperature. Tøien doesn't rank these upticks as equivalent to the periodic, full warm-ups typical of almost all small hibernators, who spike their body temperatures into the normal range every few weeks, urinate and then subside back into cold, extreme torpor. Whatever the bears' cycles mean to the animals, researchers who inadvertently tried to measure metabolism during a shivering bout would have gotten inflated numbers for baseline hibernation he notes.

Heart rate tracking for three of the Alaska bears showed a drop from 55 beats per minute on average before hibernation to 14 erratic ones per minute in winter. Harlow says that he too has listened to hibernating bear hearts going still for a stretch and then kerthumping arrhythmically. Maybe it saves energy, he speculates.

The Alaska team also found that when bears got moving again in spring, their metabolisms took several weeks to creep back to normal. Monitoring data showed that bears with half-speed metabolic rates still displayed normal bearish behavior.

That observation fits with studies on grizzlies, which spend the first few weeks after hibernating with heart rates at half the summer speed, says Lynne Nelson of Washington State University in Pullman. "It never ceases to amaze me just how adaptable the physiologic systems of these bears can be."

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