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By Megan Scudellari

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Watching bears sleep

A "heroic" five-month study reveals the secrets of black bear hibernation

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Despite maintaining high body temperatures during the winter, bears really do hibernate, concludes a first-of-its-kind glimpse into the annual dormancy of black bears.

The research, published this week in *Science*, resolves the longstanding question about the bears' winter activities and offers novel insights into hibernation physiology, such as identifying a dramatic drop in metabolic rate.



American black bear
Credit: Øivind Tøien

"It is a really heroic effort," **Gerhard Heldmaier** of Philipps-Universitat Marburg in Germany, who was not involved in the research, said in an email to The Scientist.

Bears hibernate on average 5 to 7 months a year, during which time they don't eat, drink, urinate or defecate. Øivind Tøien and colleagues at the **Institute of Arctic Biology** at the University of Alaska Fairbanks monitored the metabolic activity and body temperature of five black bears day and night for five months, an unprecedented undertaking.

The bears -- nuisance animals captured by the Alaska Department of Fish and Game after repeatedly coming too close to humans -- were implanted with radio transmitters to continuously record body temperature, muscle activity and heart rate. With some encouragement from the researchers, the bears hibernated in artificial dens equipped with infrared cameras and activity monitors. The air in the dens was continuously collected to record oxygen

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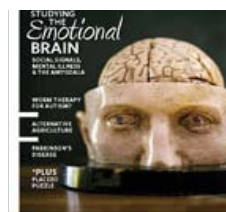
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consumption, a key measure of metabolic rate. Tøien designed software to control the system and process the data from the various tracking devices.

During hibernation, the bears demonstrated only a moderate drop in body temperature -- from 38 degrees Celsius to 33 degrees Celsius -- compared to other hibernators, like the arctic squirrel, which can drop its body temperature below freezing. In stark contrast, however, the bears' heart rates slowed from 55 beats per minute to 14 beats per minute and their metabolic activity was dramatically reduced to only 25 percent of normal levels, and remained suppressed for up to three weeks after the bears woke up.

Snoring black bear

Video by Øivind Tøien

The results settle a long-standing debate about whether bears truly hibernate. Due to their high body temperature during dormancy, some researchers have questioned whether bears hibernate like the arctic squirrel and other small mammals that reduce their body temperatures and metabolism for long periods of time.

"This question is resolved now," said Heldmaier, who wrote an accompanying *Perspective* in *Science*. "Bears truly hibernate because they actively suppress their metabolic rate to the level as is known in other hibernators."



American black bear
Credit: Øivind Tøien

But the finding raises more questions than it answers. "Their metabolism drops much more than expected from the temperature decrease," said Tøien. In general, metabolic processes are expected to slow by 50 percent for each 10 degrees an animal is cooled, but with only a 5 degree decrease, a bear's metabolism drops by 75 percent.

Other unknown mechanisms must be at play, said Tøien, such as a decrease in size of metabolically active organs or widespread decrease in metabolism of individual cells. "It's pure guessing," he said, "but we're very interested in studying it in the future."

Tøien, Ø., et al., "Hibernation in Black Bears: Independence of Metabolic Suppression from Body Temperature," *Science*, 331:906-9.

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