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Hibernating Bears Slow Down More, Cool Down Less

BY: JENNY MARDER

A hibernating black bear in a manmade "hibernaculum," a wooded area with straw for bedding, which mimicked a natural bear's den. Photo courtesy University of Alaska Fairbanks.

Understanding the strange hibernation patterns of American black bears may give scientists new clues on how to protect the brains of stroke and heart attack patients.

The metabolism of a black bear falls sharply during hibernation, to 25 percent of their normal body rate, while their body temperature stays relatively high, researchers reported on Thursday **in the journal, Science**. Unlike small hibernating animals, this indicates that black bear metabolism acts independently from body temperature, controlled by an unknown mechanism. Researchers called the findings surprising.

When most hibernating animals, such as ground squirrels, bats and marmots, fall into a state of torpor, they get cold as icicles, and their inner thermostats plummet to near or below freezing. These temperature changes affect every single biological reaction in their bodies, said Craig Heller, professor of biology at Stanford University and an author on the study.

"The ability of your heart muscles to contract. The ability of the neurons in your brain to process information. All of these things are affected by

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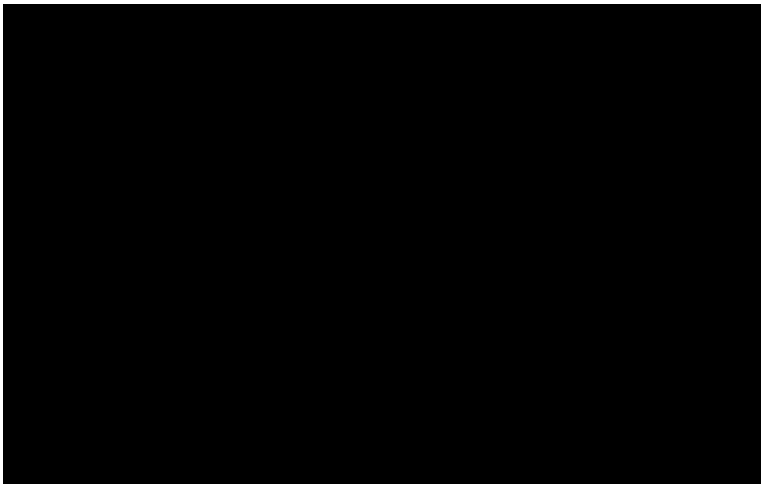
temperature," he said.

What's more, imaging research has shown that the brains of these small hibernators reorganize as they move in and out of hibernation. "When they go into bouts of torpor, they lose about 25 percent of the structure in major parts of their brains," Heller said. "When they come out, it grows back."

Such rewiring is temperature dependent, and may compromise the animal's brain behavior. Bears, Heller said, may avoid those brain changes by only slightly reducing their temperature.

During hibernation, bears don't eat, drink, urinate or defecate for five to seven months. They lose their circadian rhythms and their breathing slows to as low as a breath a minute. Their hearts can stop for as long as 20 seconds, said Brian Barnes, who directs the Institute of Arctic Biology at the University of Alaska at Fairbanks.

Oivind Toien, the paper's lead author, who often commutes to work on cross-country skis, showed a video of a hibernating bear at a press briefing on Thursday afternoon, with sounds of heavy breathing and deep, gruff snores. "Notice the long silence between breaths," Toien said. "During that time, the bear's heart beats very slowly."



Scientists captured the bears by tranquilizing them in their natural dens, hauling them out in stretchers and transporting them to the Institute of Arctic Biology at the University of Alaska, Fairbanks where they implanted them with electrodes, electrocardiograms and temperature probes.

The bears studied were deemed a "nuisance" to human communities, and slated for destruction.

The animals were then moved to an airtight, manmade "hibernaculum," a wooded area with straw for bedding, which mimicked a natural bear's den. Infrared video cameras recorded their behavior. Oxygen was pumped in at a constant flow rate. From inside a nearby room, researchers monitored their temperature and heartbeat, and measured oxygen levels in the den to determine their metabolism rate.

The bears' metabolism was expected to return to normal when they emerged from hibernation. Instead, it took them two to three weeks to recover.

Researchers hope that a better understanding of the bear's body mechanisms will ultimately help inform medical treatment. Brain damage can occur after a stroke when the supply of oxygenated blood to the brain drops, while the demand stays high. Lowering metabolism in humans could help lower this demand, possibly providing a quick response to stroke or heart attack.

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"A tremendous goal right now in medicine is to be able to induce hypothermia," Heller said. "If you have a stroke or any sort of ischemic disease like a heart attack, you can dramatically reduce damage to the brain, if you can reduce temperature, by only a couple of degrees. If we could find out how the bears do this... we could dramatically reduce damage and costs."

Future research will may focus on grizzlies or polar bear, which are larger and thus, may be able to hibernate at even higher temperatures. "That's in the future," Barnes said. "We'll need a bigger box."

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