ANIMALS

Proven: Bears Hibernate (and Soon You Could Too)

By JEFFREY KLUGER Friday, Feb. 18, 2011

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Until very recently, everything we knew about bear hibernation could be fairly well captured in a single sentence: We're pretty sure they do it. They disappear into dens for months at a time, they emerge in the spring looking a whole lot skinnier, and we're reasonably sure they didn't send out for any food. Hibernation is the only thing that explains all of that.

But whether the long winter nap bears appear to engage in qualifies as true hibernation has always been another matter. The natural seasonal cycles of zoo bears are completely disrupted by the very fact of their captivity, and studying them thus yields little. As for nonzoo individuals, well, you know that whole thing about not waking a sleeping bear? Scientists take that seriously. **(Watch TIME's video "What Is Killing America's Bears? We Are.")**

"Metabolism in the large hibernators of the bear family *Ursidae* have remained unknown because of technical limitations," is how research associate Oivind Toien of the University of Alaska Fairbanks and his colleagues dryly put it in a new paper in the journal *Science*.

Those "limitations" have confined biologists studying hibernation to working with small mammals, such as marmots, ground squirrels, bats and certain kinds of marsupials. They definitely

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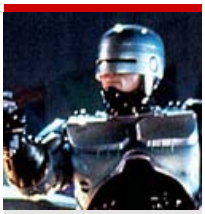

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hibernate, and since their body size makes them easier — not to mention safer — to study in the lab or wire up in the wild, their metabolic processes are well understood. During hibernation, these species reduce their body temperature to a point that approaches or even falls below the freezing point of water. (Salty body fluids have somewhat lower freezing thresholds that keep tissues from crystallizing.) Overall metabolism drops a stunning 98% — just 2% above dead.

What you can learn from small animals, however, does not easily scale up to big ones. A mouse can fall down a mine shaft and emerge unhurt after all, but if you fall even 30 ft. to a sidewalk, you'd break your legs — or worse. What's true for biomechanics can be true for metabolism, too, and the only way to learn exactly how bears make it through a long, cold, foodless winter was to monitor them in the wild as they actually do it. Toien and his colleagues figured out a way.

(See pictures of Germany's polar-bear celebrity.)

First, they had to persuade state wildlife officials to let them have possession of five American black bears — two females and three males — that had been captured as nuisance animals in south-central or interior Alaska. The animals were shipped to the university's Institute of Arctic Biology and there underwent surgery to have biological sensors implanted. The wired bears were then transferred to a protected wooded area that had already been equipped with artificial dens — essentially double-walled plywood boxes with Styrofoam insulation between the walls and a plastic curtain for a door made of overlapping flaps like the ones used in grocery-store refrigerator cases. The floors of the boxes were filled with some familiar straw taken from the animals' original dens and fluffed up with fresh straw. That sounds spartan, but to a bear it's five-star stuff.

The animals took readily to the dens and in November, as the winter approached, they settled in for a long sleep, while the scientists monitored their vital signs and watched their behavior on video cameras. The bears did what hibernating bears are supposed to do, which is to say they slept — almost always in a curled position that retained both heat and hydration. They changed their positions once or twice a day, standing up, sometimes grooming a bit and rearranging their bedding. Then they flopped back down.

What was more important than the bears' external behavior was what went on inside. Core body temperature dropped from a maximum of 100.4°F (38°C) before hibernating to a minimum of 85°F (29°C) during hibernation. That's nowhere near the freezing temperatures the small critters achieve.

(Read "Will the Polar Bear Survive?")

The bears' heart rates were all over the place. The maximum rate achieved by any of the animals at rest during the summer months was 63.7 beats per minute. The minimum reached by the most deeply torpid one in the winter was 8.9. But moment to

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moment, the rate would accelerate and slow, moving along at a relative trip-hammer pace after a breath was drawn, and falling into the single digits after an exhalation. Heart rates also increased when the bears were shivering, which happened periodically if their temperature fell too low.

The most revealing metric was the bears' overall metabolism. Deep sleep notwithstanding, they did not approach the small mammals' nearly lifeless 2% rate. Yet theirs did plummet dramatically, to just 25% of the normal summertime level. What's more, when the bears emerged sometime in March, their metabolism had climbed only to 43% of average. Know how you feel when you stagger out of bed first thing in the morning? Now imagine you'd been sleeping from Thanksgiving to St. Patrick's Day. It was weeks before the bears' internal engines were again running at summertime levels.

So is all of this true hibernation — and why in the world does it matter either way? The scientists did conclude that the bears well and truly qualify as hibernators. Their greater level of metabolic activity may seem almost hyperkinetic compared to the marmots', but that's only a function of the fact that their large bodies need more energy to operate. As a result, their systems have to be kept on a very low simmer instead of going into near total shutdown.

(Comment on this story.)

The significance of the study is more speculative — but intriguing. The findings could lead to the development of what the scientists called "novel clinical therapies." That might mean learning how to induce a healthy hibernation state in a gravely ill person who is awaiting a transplant or an as yet unapproved drug of some kind. It could also have much later implications for long-distance space travel, during which the ability to sleep for months at a time could make the tedium of the journey a lot more tolerable. The bears may be the source of the knowledge that makes all this possible, but if so, they're indifferent to it. All they want is a little shut-eye.

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