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## Bears: Hibernation reveals unique skills

Black bears can decouple body temperature and metabolism

Black bears are among the mammals, the winter months in hibernation each fall. In Science, researchers now report that the bears here have some surprising characteristics: they reduce their metabolic activity and heart rate to only a quarter of the normal rate without at the same time to reduce the body temperature. This decoupling of temperature and metabolism is unprecedented among large mammals.



Black Bear in sleep monitored cave  
© Øivind Tøien / University of Alaska

The Alaska black bears spend each year for five to seven months without food, without drinking and without faeces or urine leave - they are in hibernation. While it is fairly well known for smaller hibernating mammals such as hedgehogs, such as body functions and metabolism in progress during the rest period, this was for large mammals like bears virtually unexplored. Now, researchers at the University of Alaska for the first time the winter sleep of the black bears studied under natural conditions - and surprising discovery.

For black bears in the study are comparable to natural caves were placed deep in the woods, which were equipped with infrared cameras, activity detectors and other sensors. To body temperature, heart rate and muscle activity to monitor the bears, the researchers implanted each animal also has a measuring chip transmitter. For five months, the bears were then monitored continuously during their winter sleep.

### Unusual high temperature and long

The analysis of the data was astonished: The body temperature of the black bears ranged in slow cycles of two to seven days 30-36 ° Celsius. So strong, for several days reaching cycles for no other hibernating animal, previously known. Decreased the temperature to 30 ° C from beginning to shake the bear until it is again increased.

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"An important indicator to understand what happens to the metabolism of the bears, their body temperature," says Øivind Tøien from the Institute of Arctic Biology at the University of Alaska at Fairbanks. "We know that the Bears cut the hibernation their body temperature to some extent, but in Alaska, we found that regulate this black bear their core temperature in variable cycles over the life of several days. The smaller hibernators do not and to our knowledge, this has been observed in mammals also never before. "

### Metabolism by 75 percent throttled

The measurement of metabolic rates of oxygen consumption of the animals also showed that these levels declined during hibernation to record-breaking 75 percent compared to the summer values. At the same time also the heart rate slowed by about 55 beats per minute to about 14 beats per minute.

This strong reduction is highly unusual, since it seems not to be directly coupled with the lowering of body temperature: is known from other hibernators that chemical and biological processes are slowed down at each ten-degree temperature reduction by about half. The black bears, however, lowered their core temperature by more than five to six degrees, yet their metabolic rate dropped by 75 percent massive, well more than expected.



American black bear from Alaska  
© Øivind Tøien / University of Alaska

### Heart rate of respiration influences

And one more special feature, the animals' sinus arrhythmia, a variation of heart rate is relative to the respiration and the bears show an extreme form of it, "said Tøien. "If they take a breath, her heartbeat is almost normal. But between breaths, the heart of the bear beats very slowly. Sometimes, up to 20 seconds between shots. Each time the bear breathing faster, his heart for a short time. When he exhales, the heart slows down again. "

Interestingly, the metabolic activity returned in the spring, back to the end of hibernation, not immediately to full power. The surprised researchers found instead that the metabolic rates of two to three weeks, remained at half power, before they again reached full capacity.

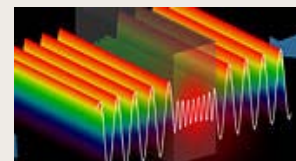
### Application in medicine possible

Taken together, the results show a unique picture of hibernation in a man-sized mammal. The new findings provide new impetus for the research, but also for future medical applications. "When black bears emerge from their winter dens in spring, they have hardly lost muscle and bone mass," said Brian Barnes, also from the University of Alaska. Would a man as long as almost motionless through the winter, were with him decomposed bones and muscles strong and only limited operational. Apparently, the bears have special genetic adaptations to prevent such degradation.

"If we could discover the genetic and molecular basis of these adjustments, there would perhaps be possible to develop new therapies and drugs that prevent such as osteoporosis and muscle loss in humans. Or are we serious injuries could in a kind of resting stage displaced until they can be placed in appropriate medical treatment "According to the researchers, could the knowledge be useful to the mechanisms of hibernation in the distant future, even for long-term space travel -. To

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astronauts into hibernation to move. (Science, 2011 DOI:  
10.1126/science.1199435)

(American Association for the Advancement of Science, 02/21/2011 - NPO)

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