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Can dormant bears help us heal?

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Tim Laske, adjunct professor of surgery at the University of Minnesota and director of engineering at Medtronic, held a EKG sensor over the heart of the yearling collecting heart rate data.

Harkness, Kyndell, Star Tribune

CAMP RIPLEY, MINN. - For two winters now, a mother bear has been denning on George Vilinski's land. A few tracks last spring are the only signs he has seen.

"She's like a ghost," he said.

But researchers are hoping this bear and others around the state will reveal some mysteries about hibernation -- and how it might be used to help humans.

"It could have a lot of positive benefits if we find out what these bears are doing," said Paul Iaizzo, a surgery professor and principal investigator at the University of Minnesota's Visible Heart lab.

Recently Iaizzo and a team of researchers from the University of Minnesota, Medtronic and the Department of Natural Resources visited the bear on Vilinski's land, and others in northern and northwestern Minnesota, to see what they might be able to detect from small heart monitors they implanted last spring.

Hauling nearly $150,000 worth of computers, electrocardiographic recording devices, infrared cameras and ultrasound equipment (not to mention surgical equipment and 40 pounds of batteries) through the woods, the team set up a makeshift physiology lab on the snow only yards downhill from the snow-covered den in a knot of tree roots next to a small pond. For the next few hours they would use it to paint one of the most detailed pictures to date of a bear's inner workings.

It's already known that bears in hibernation don't eat, drink, urinate or defecate for five months. Yet they don't starve. By recycling their own waste, they avoid buildups of toxins. They don't exercise, yet they lose only a fraction of the muscle strength humans would if they were idle that long. Their hearts might slow to five beats per minute, yet they maintain heart strength and structure.

Unlike other animals such as squirrels, whose hibernation temperatures can drop to near freezing, bears' body temperatures drop only a few degrees. With predators (and researchers) combing the woods, they also remain alert and able to spring into action, contrary to the popular understanding of hibernation as a long snooze.

If humans someday could be made to perform the same tricks as bears, they might use them not to get through winter, but to recover from injury, surgery or long periods of bed rest. Iaizzo's lab has shown that substances that cause a bear to go into hibernation may have applications in humans to protect organs from damage from oxygen deprivation.

The National Aeronautics and Space Administration also has funded some research on bears in the belief that their retention of muscle strength could be adapted to help astronauts reduce atrophy during long periods in space.

"There are numerous things about bears that are miraculous, based on what we know about human physiology, and what we believe mammals can tolerate," Iaizzo said. "But the more work we do, the more questions that arise."

Little laboratory in the woods

Answers to some of those questions came in their north woods laboratory.

The team already knew that a hibernating bear might slow its heart and breathing to rates that would cause a human to

faint, yet with a single breath could boost its heart's blood and oxygen-pumping capacity eightfold. They also knew that the mother bear they were testing was known for a high level of vigilance in hibernation.

"She's the angry female," said Brian Dirks, Camp Ripley animal survey coordinator. "She doesn't sleep very sound."

Tim Laske, an adjunct professor of surgery at the University of Minnesota and engineering director at Medtronic, learned that when he slipped a camera attached to a long stick into her den as she seemed to be slipping under the effects of a tranquilizer. In a flash she was lunging teeth-first at the lens.

More than an hour later, confident that the 251-pound mother bear was tranquilized, the team dragged her onto plastic yoga mats, where Laske would try to find the implanted heart monitor. It's a titanium device about the size of a computer flash drive, and Laske didn't have much hope. Bears have strong immune systems that have rejected devices in the past, and nine months in the brush can be tough on high-tech electronics.

Laske patted the bear's chest. "Here it is!" he shouted. Within minutes, Iaizzo had attached electrodes to the bear's chest and to a computer, and measurements of the bear's heart rate, stored since March 7, poured into a database.

It was, Iaizzo said, "data no one else really has from an animal that's been out in the wild for nine months."

Laske noted that the bear had experienced 60,126 episodes of bradycardia -- periods with extremely low heart rate, sometimes stopping altogether for as long as nine seconds. (One of the other bears reported pauses of more than 14 seconds.) Second assessment: She'd gone into hibernation in late November.

After the first data download, Iaizzo brought up some ultrasound images on a small screen of the interior of the bear's heart as it beat -- similar to those used to check development of fetuses. An electrocardiographic monitor measured the heart's electrical and mechanical activity.

After two hours of body measurements, blood tests and other exams by Dirks and DNR bear biologist Dave Garshelis, the mother and cub were shoved back into the den.

They won't remember a thing

The bears, Iaizzo said, wouldn't recall the encounter. But the researchers expect to be replaying it quite a bit, through the piles of data they downloaded.

Lynn Rogers, director of the North American Bear Center in Ely and a world-renowned bear researcher, said the implanted devices seem to corroborate research done several decades ago. "That's a good thing," he said. Rogers uses time and trust to approach bears and measure their heartbeats by hand; he said he would never use an implant. But he said he'll be interested in further results from the devices.

Laske and Iaizzo said researchers have their fingers crossed that some features of hibernation might someday be induced in humans. Conservation of the heart's energy, particularly, might help injured people's bodies focus on healing. Substances that induce hibernation might be used to preserve donor hearts for longer periods before they are transplanted, as well as to protect heart muscles from further damage after an attack.

"I think where we owe the bears a debt of gratitude is in learning things we previously didn't think were possible, and opening the minds of scientists to other possibilities of human therapies," Laske said.

At his home near the bear's den, Vilinski said he's looking forward to spring when the researchers return to check on the bear and her cub.

"Having [the bears] out here like this, I enjoy it," he said. "It's interesting. I just wish a guy could see her once in a while."

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