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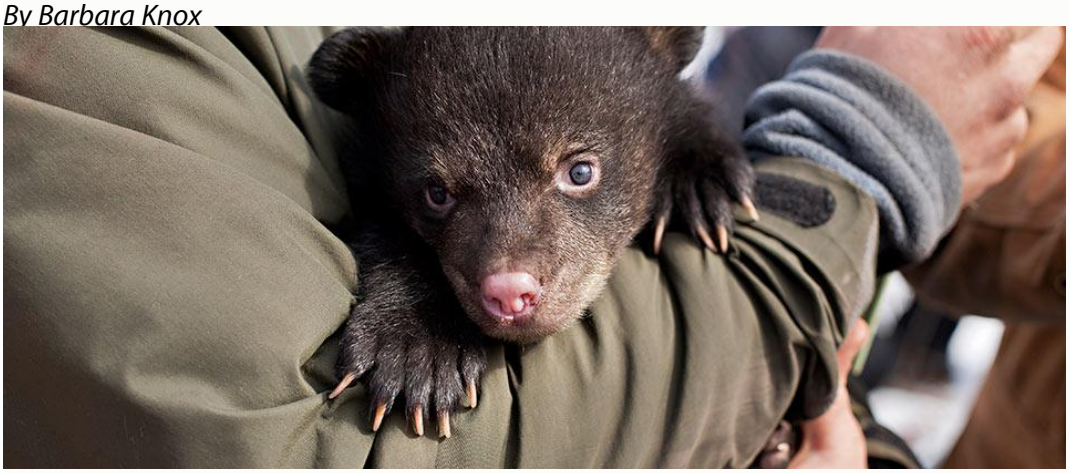
From the lab to the north woods

How an ongoing partnership with Medtronic fuels discovery, with implications far beyond the University's walls

By Barbara Knox



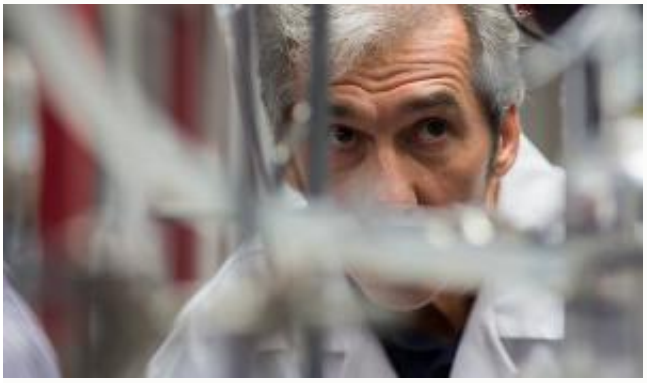
U of M research on bears' hibernation is leading to advances in preserving organs for transplant surgery and helping bedridden people avoid clots. (Photo by Ann Arbor Miller)

As days shorten and winter sets in, University of Minnesota professor Paul Iaizzo makes his first of two annual treks to northern Minnesota to visit black bears in their dens. In the first trip, Iaizzo and his team assess the bears' appearances and heart physiology and take blood samples in an attempt to understand not just the mysteries of hibernation, but also how that knowledge could help humans.

Consider the implications: it's well documented that a sedentary

lifestyle in humans can be a contributing factor to blood clots, heart failure, obesity, osteoporosis, and atrophied muscles, but hibernating bears—despite lying virtually motionless for at least five months every winter—don't appear to suffer from any of those ailments. The bears don't eat, drink, urinate, or defecate, yet they still emerge from their dens healthy in the spring.

Working with longtime collaborator Tim Laske, vice president of research and development for Medtronic Inc., with which Iaizzo's renowned Visible Heart Laboratory has had a research contract for more than 17 years, and Dave Garshelis of the Minnesota Department of Natural Resources, Iaizzo has already learned a lot about hibernation.



Paul Iaizzo (photo by Brady Willette)

He's shown that the free-ranging black bears they're studying lose little muscle strength—or suffer no loss at all in some muscle groups—during hibernation. The team also has demonstrated that hibernating bears' physiology favors muscles involved in their fight-or-flight responses, meaning that a hibernating bear can still respond quickly if disturbed by predators. Now with the help of U scientist Tinen Iles, the group is studying the bears' blood clotting times in an effort to understand why bears don't develop clots despite months of inactivity, and whether that knowledge could help bedridden people avoid the risks of clots.

"Our biggest hope," says Iaizzo, "is that we'll be able to use

components of hibernation induction triggers in human patients to enhance the via-bility of the affected tissues or, even better, preserve organs for transplant surgery."

A gift of knowledge

Tucked away in the very basement lab where the first pacemaker was tested in the late 1950s by eventual Medtronic cofounder Earl Bakken, Iaizzo's Visible Heart Laboratory today is internationally known for its groundbreaking work on reanimating human hearts that have been deemed unsuitable for transplant but can be used for educational purposes. Its "Atlas of Human Cardiac Anatomy," a free-access online resource, acts as a clearinghouse for a vast array of educational information about the human heart, including videos, diagrams, scans, photographs, and 3-D modeling.

"We all can learn so much from these hearts that are donated as gifts to us from the organ donors and their families," says Iaizzo, a professor in the Medical School departments of Surgery and Integrative Biology and Physiology, as well as the Carlson School of Management. "In turn, we want to give the knowledge that we gain from those hearts back to the public."

Iaizzo has shown that using delta opioids, which play an important role in triggering hibernation, can reduce cardiac tissue death by 50 percent in swine hearts, which are quite similar to human hearts. He's so convinced that preconditioning agents like delta opioids could improve tissue health that he uses them on almost every human or swine heart reanimated in his lab.

"Right now a human heart is viable for transplant only four to six hours once it's isolated out of the patient," Iaizzo says. "Logistically, that's a nightmare. But what if, by preconditioning it with these delta opioids, we could extend a heart's viability to eight or even 10

or more hours? That would be huge."

The Medtronic factor

The bear research is just one of many collaborations between Iaizzo, who directs education for the U's Lillehei Heart Institute, and Medtronic. In fact, the pioneering medical device company has an exclusive research contract to make use of his U laboratory.

"Medtronic is a great academic partner," says Iaizzo, who holds the Medtronic Professorship in Visible Heart Research. "Their support allows us to train graduate medical and undergraduate students, as well as improve our educational outreach. It's allowed us to better understand cardiac health, promote medical careers to young kids, and develop this black bear research."

And for Iaizzo, one of the most exciting parts of the partnership is the exchange of scientific knowledge. His Visible Heart Lab staff shares information on heart anatomy with not only Medtronic engineers but also those from other companies, and those companies share cutting-edge information about the needs of the medical device industry with U scientists. And as a training ground for U of M students, the Visible Heart Lab has been unmatched.

"We've got dozens of former students now working not just at Medtronic, but also at places like Boston Scientific, 3M, and St. Jude Medical," says Iaizzo. "It's incredibly intellectually satisfying to work with the bright people in our local medical device industry—it's really opened my eyes to the phenomenal brain trust that Minnesota has."

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