

Stillwater, Okla.—Dr. Michael Davis, a professor in the Physiological Sciences Department at Oklahoma State University's (OSU) Center for Veterinary Health Sciences, will present research on the mysteries surrounding the ability sled dogs have to run 1,100 miles through the harshest conditions. His presentation is part of the American Physiological Society's conference, The Integrative Biology of Exercise V, being held Sept. 24-27, 2008, in Hilton Head, S.C.

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Racing sled dogs are best known for their “mushing” each March during the Iditarod Trail Sled Dog Race, the world's longest sled race. They are the premier ultra-endurance competitors, covering 1,100 miles from Anchorage to Nome, Ala., sometimes in just nine days. It is unclear how they can keep running, despite heavy blizzards, temperatures as low as -40°F , and winds up to 60 mph. No other animal has been found to come close to the physiological attributes these dogs display.

Davis has focused on the mysteries of this breed for more than a decade. During the conference, he will discuss his recent findings entitled, “Metabolic Strategies for Sustained Endurance Exercise: Lessons from the Iditarod.”

How Do They Do It? The Exercise Physiology of Sled Dogs

The physiological understandings that Davis and his colleagues have uncovered thus far are extensive. Among their findings are:

Rapid Adaptation to Exercise and Endurance—The most striking feature of these canines is their ability to rapidly adapt to sustained strenuous exercise in 24-48 hours. Conditioned dogs display most of the metabolic changes that are found in human endurance athletes during their first day of exercise, including depletion of muscle energy reserves, increases in stress hormones, evidence of cellular injury (such as to proteins, lipids and DNA), and oxidative stress. However, with subsequent consecutive days of exercise at the same intensity, these changes are reversed. Within four days after exercise begins, the metabolic profile of the dogs returns to where it was before the race began, despite their sustained, strenuous exercise. When human ultra-athletes become fatigued, they stay that way until a period of recovery that may take a full day.

Enormous Aerobic Capacity—Racing sled dogs have enormous aerobic capacity. While the untrained sled dogs have an average aerobic capacity of 175 ml/kg/min VO_2 max (ratio of volume of oxygen to body weight per minute), the aerobic capacity of the fully conditioned sled

dogs is estimated to be about twice that (300 ml/kg/min).

Using a High-Fat Diet to Fuel Exercise—During periods of racing, sled dogs can burn up to 12,000 kilocalories per day (kcal/day). This means that a 55-pound sled dog will consume the equivalent of 24 McDonald's Big Macs to fuel their run on any given day. Some of the running dog's high-fat diet is converted to energy in the liver and used as fuel in the initial stages of exercise. Preliminary data suggests that this process is a desirable trait intended to efficiently support exercise in the racers. It is worth noting that humans would need 72 Big Macs to fuel the power they need to make a day's run, assuming their body could absorb and process all the fat contained in the beef.

Next Steps

The mechanisms that make these four-legged athletes premier in performance are still unknown. Davis theorizes that it may involve the regulation of extremely thin membranes in the muscle fibers and changes in the cells that are responsible for the body's energy production.

"These are one-of-a-kind athletes," says Davis. "What we learn from them will undoubtedly tell us a lot about human performance as well."

Davis teaches Exercise Physiology. He is the director of the Comparative Exercise Physiology Laboratory located at the Veterinary Center. He earned his Doctor of Veterinary Medicine degree from Texas A&M University, a MS in Veterinary Science from Virginia Tech and a Ph.D. in Physiology from Johns Hopkins University.

The Oklahoma State University Center for Veterinary Health Sciences is one of 28 veterinary colleges in the United States and is fully accredited by the Council on Education of the American Veterinary Medical Association. For more information, visit www.cvhs.okstate.edu or call (405) 744-7000.

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