

Taking the heat: Asian elephants simply 'ride out' high daytime heat load

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Scientists at the University of Veterinary Medicine, Vienna's Research Institute of Wildlife Ecology have discovered the mechanism by which Asian elephants are able to tolerate hot daytime temperatures. Their results are published in the current issue of the international *Journal of Comparative Physiology B*.

The heat is on where elephants roam. Daytime temperatures in the natural environment of Asian elephants (*Elephas maximus*) average between 30 and 35 degrees Celsius. Elephants do not sweat or pant to cool down and their small surface-to-volume ratio restricts [heat loss](#). Experts have long suspected that elephants may have a [heat storage](#) mechanism similar to that used by [camels](#) and other desert mammals. Scientists at the Research Institute of [Wildlife Ecology](#) (FIWI) at the University of Veterinary Medicine, Vienna have now shown convincingly that Asian elephants respond to high [daytime temperatures](#) by significantly lowering their body temperature during the cooler night hours. By doing so they create a kind of thermal reserve that allows them to store heat and so prevent [heat stress](#) as temperatures rise during the day. This finding is particularly interesting because it raises the possibility that heat storage is much more widespread among mammals than previously thought.

Heterothermy is an adaptive mechanism by which body temperature fluctuates in response to environmental temperature, decreasing at night when it is cooler and increasing gradually in the daytime. The FIWI researchers have investigated whether elephants make use of

heterothermy. To do so, they fed small telemeters to a group of captive elephants in Thailand and a [control group](#) at the Munich Zoo Hellabrunn to monitor temperatures in the animals' gastrointestinal tract. This telemetry system, which permits the continuous recording of temperature, had previously been developed at the Research Institute of Wildlife Ecology. Statistical analysis of the data confirmed the scientists' expectations: the overall mean body temperature was similar in both the Thai and the German study groups but fluctuations in body temperature were on average twice as large in the Thai animals as in the German individuals. The Thai animals had both a higher daily peak temperature and a lower minimum temperature, which the scientists related to the higher mean ambient temperatures in Thailand. In fact, the body temperature of the Thai elephants dropped at night to well below the normal average. This means that Thai elephants start the day with a much larger thermal reserve than their German counterparts.

Thomas Ruf, an expert in animal physiology and co-author of the study, is excited by the new results. "The phenomenon of heterothermy as a thermoregulatory mechanism was known from desert animals such as camels, antelopes and small desert rodents but it was surprising to find it in non-desert mammals. Our findings raise the intriguing possibility that heterothermy may be far more widespread in mammals than previously assumed". This will certainly be an interesting topic to investigate in the future and the temperature sensors developed in FIWI should provide the scientists with a good handle to tackle it.

More information: The article "Taking the heat: thermoregulation in Asian elephants under different climatic conditions" by Nicole M. Weissenböck, Walter Arnold and Thomas Ruf is published online in the "Journal of Comparative Physiology B"

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