SELECTIVE BRAIN COOLING AND THE CRANIAL ARTERIOVENOUS TEMPERATURE DIFFERENCE IN FREE-RANGING ORYX (ORYX GAZELLA)

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The arid-zone antelope, the oryx, is often cited as a prime example of an animal that benefits from selective brain cooling. Whether oryx employ selective brain cooling never has been investigated. We implanted miniature data loggers connected to thermistors into oryx (*Oryx gazella)* under etorphine- induced, and halothane (1-2%)- maintained, general anaesthesia. We measured the temperature of carotid arterial blood (T_{car}) and the hypothalamus (T_{hyp}) in two male and two female oryx every five minutes, to an accuracy of better than 0.1°C, over periods ranging from six to fifteen days during the southern hemisphere summer. The animals were ranging free in their natural habitat during data collection. Three of the animals used selective brain cooling as part of their daily thermoregulatory repertoire, usually in the late afternoon and evening at the peak of their nychthemeral rhythm, but apparently never during exertional hyperthermia. One male did not use selective brain cooling during the study period. Our hypothesis is that selective brain cooling serves to modulate thermoregulation, rather than to protect the brain from overheating. Implementation of selective brain cooling reduces hypothalamic temperature and therefore attenuates heat loss effectors. Conversely, cessation of selective brain cooling excites heat loss effectors. Respiratory evaporation ought to reflect in cooling of cranial blood, with respiratory heat loss proportional to the product of cranial blood flow and the difference between T_{car} and jugular blood temperature (T_{jug}). In one male and one female T_{jug} also was measured. On average, T_{jug} was 0.3 ± 0.2°C cooler than T_{car}, but there were times when T_{jug} was warmer than T_{car}. At high body temperatures T_{jug} was significantly cooler when the oryx were not using selective brain cooling than when they were, consistent with enhanced respiratory heat loss if cranial blood flow was not reduced concurrently. In fact, cranial blood flow increases as body temperature increases (Maloney and Mitchell, 1997), with blood flow to the upper respiratory tract, including the nasal mucosa, accounting for the majority of the change (Hales, 1973). Thus free-ranging oryx can employ selective brain cooling but we found no evidence that SBC was employed to protect a thermally vulnerable brain. Instead, cessation of selective brain cooling, at high body temperatures, increased respiratory heat loss. Our results concur with the putative role of selective brain cooling as a governor on water use for thermoregulation.

Hales J.R.S. (1973) Effects of exposure to hot environments on the regional distribution of blood flow and on cardiorespiratory function in sheep. *Pflugers Arch.* 344:133-148.

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