BRAIN, CAROTID ARTERIAL BLOOD, AND ABDOMINAL TEMPERATURES IN UNRESTRAINED BABOONS

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Baboons (*Papio ursinus*) are the only diurnal non-human primates to have colonized the open grassland savannas and arid sand plains of Africa. One hypothesis seeking to explain their success invokes selective brain cooling, dependent on evaporation within the large muzzle (Wheeler 1988), but no one has investigated whether baboons actually can employ selective brain cooling. Another potential mechanism is adaptive heterothermy; baboons living in the Namib Desert have a nychthemeral rhythm of body core temperature with amplitude that exceeds 3°C, which is increased to ~5°C when they do not have access to drinking water (Brain and Mitchell 1999). We habituated baboons that originated from troops inhabiting the mesic southern boundary of South Africa to a constant-temperature environment (25°C) in an indoor animal house. We implanted fine thermistors, in guide tubes, into one carotid artery and into the brain, just dorsal to the hypothalamus, using ketamine (10 mg/kg i.m.) sedation, thiopentone sodium (4 mg/kg i.v.) induction and halothane (2% inhalation) anaesthesia. The leads from the thermistors were tracked subcutaneously to miniature thermometric data loggers in the baboons' abdominal cavities. We also inserted a logger in the abdominal cavity itself. All loggers had a calibrated accuracy of <0.1°C. After recovery from surgery, the baboons were transferred, in pairs but in separate cages, to a climatic chamber where we could control dry-bulb temperature and humidity, and impose a 12-hour (06:00 to 18:00) light/dark cycle. Baboons were fed and their cages cleaned once a day, but otherwise were disturbed as little as possible. They were exposed for seven consecutive days to a constant benign environment (23°C, 12 g/m^3 absolute humidity), and also to a cyclic environment which was ramped from 15°C, 9 g/m^3, at 08:00 to 35°C, 15 g/m^3 at 10:00, and then back to starting conditions between 15:00 and 17:00. Mean radiant temperature was equal to air temperature, and wind speed was <0.5 m/s. For two of the days, in both the constant and the cyclic environment, water was withheld from the baboons, and fruit removed from their diet; on all other days they had water *ad libitum.* Carotid artery and abdominal temperatures were similar, and showed a nychthemeral rhythm with acrophase around mid-day, and a trough-to-peak amplitude of about 1°C in the 23°C environment. The amplitude was increased by diurnal heat stress, without nocturnal temperatures being affected. The amplitude was more than doubled by the combination of diurnal heat stress and water deprivation, but did not attain that exhibited by dehydrated *P. ursinus* in the extreme Namib Desert environment. Brain temperature never was less than arterial blood temperature, and reached 40°C in the heat-stressed dehydrated baboons. *P. ursinus* therefore does not appear to have the capacity for selective brain cooling. The baboons' success in African arid zones may depend, however, on employment of adaptive heterothermy, to conserve body water.

Brain C., Mitchell D., 1999. Temperature changes in free-ranging baboons (*Papio hamadryas ursinus)* in the Namib Desert, Namibia. *Int. J. Primatol.* 20:209-217.

Wheeler P., 1988. Stand tall and stay cool. *New Sci.* 118(1612):62-65.

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