**Methods**

In order to test our hypothesis that $\Delta T(M)$ increases with body mass, to the best of our knowledge, we included all available data in Table 1 that met three criteria. First, temperatures were measured in the same individuals both at rest and at or near $\dot{V}_{O2}^{max}$ (≥ 70 % $\dot{V}_{O2}^{max}$). Measurements of $\dot{V}_{O2}^{max}$ were made using the standard method whereby animals were run on treadmills that varied in speed and/or the degree of incline as in Weibel *et al.* (2004). In a few studies, it was not explicitly stated that the animal was performing at or near $\dot{V}_{O2}^{max}$, but we assumed this to be the case if heart rate and/or blood lactate concentration had plateaued after strenuous exercise, based on the criteria of Weibel *et al.* (2004).

Second, experiments were performed at or near the same ambient temperature. We used this criteria because environmental temperature clearly may affect rates of heat loss, and thus body temperature in mammals under strenuous activity. For 14 of the 17 data points, ambient temperature ranged between 16 and 28 $^{o}$C, with most temperatures between 20-22 $^{o}$C (Table 1). For the remaining 4 points, environmental temperature was not explicitly mentioned, but was assumed to be near ambient temperature (~ 20 $^{o}$C).

Third, core body temperature was measured at rest and at or near $\dot{V}_{O2}^{max}$. Core body temperatures were recorded in the colon (n = 2, rat and mouse), in the blood (n = 7, aorta, carotid or pulmonary arteries), or in the muscles used in locomotion (n = 8). These data include two studies where both muscle and blood temperatures were measured on the same individuals (Table 1). In small mammals, colon or rectal temperatures are a good indication of core body temperature, though not necessarily a good indication of muscle temperature (Ardevol *et al.* 1998). In larger mammals, colon or rectal temperature measurements are often not a good indication of core or muscle temperatures (Kruk *et al.* 1985; Jones *et al.* 1989; Febbraio *et al.* 1994; Weishaupt *et al.* 1996) at or near the time of $\dot{V}_{O2}^{\max}$ because of a time lag between these measures. Blood temperatures are a better indicator of core body temperature in both large and small animals, but these too may lag a small amount behind that of muscle temperature at the time of $\dot{V}_{O2}^{\max}$ in larger animals (Jones *et al.* 1989; Hodgson *et al.* 1993; Weishaupt *et al.* 1996). Thus, to most accurately assess any changes in muscle temperature with body mass, we performed a linear regression analysis on a subset of the data in Table 1 that included data where temperature was recorded in the muscle, and where ambient temperature was clearly stated in the study (n = 7, 4 species). We only use the statistical relationship derived from these data to test model predictions. For comparison, however, we present all data in the results.

To test our model prediction, we used the data of Taylor et al. (1981). While we recognize that there is likely some minor variation in ambient temperature, this would be small relative to more recent compilations of data where environmental temperatures range by as much as 30 $^{o}$C. Note also that we exclude from analyses the two smallest species from this dataset (0.007 and 0.090 kg) because data were not available to assess changes in muscle temperatures for species smaller than a rat (0.2 kg). As such, we make no predictions for mammals smaller than a rat or larger than a horse. Exclusion of these data resulted in an insignificant increase in the exponent of the overall scaling relationship (0.813 vs. 0.808). We estimated the $\Delta$T for species in Taylor *et al.* (1981)

using the regression relationship shown in Figure 1. This method assumes that all mammals are of similar athletic ability. Thus, for any single species it may under- or overestimate changes in temperature depending on athletic ability.

**References for Supplementary Materials**


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