Artiodactyl success and the carotid rete

As Dr Janis emphasizes (Janis 2009), the success of artiodactyls during the post-Eocene period is mainly attributed to the development of a rumen. We agree that this adaptation was important and said so in our paper (Mitchell & Lust 2008). Dr Janis is incorrect in saying that we proposed artiodactyls had a competitive advantage over perissodactyls and that their success was ‘at the expense of perissodactyls’. In fact, we discounted this idea and focused on a non-competitive explanation for their success. Environmental and body temperatures are as important in the life of animals as nutrition. Selection for the very complex behavioural and physiological mechanisms of temperature regulation is crucial to the survival of species. These mechanisms include hibernation, migration, evaporative cooling mechanisms, non-shivering thermogenesis and mechanisms that alter the core:shell thickness ratio. Most species have evolved one or more of them, including perissodactyls that have lived in less than congenial climates. Anatomical adaptations that facilitate thermoregulation, such as the carotid rete and the extensive modifications to the anatomy of the blood supply to the nasal mucosa and the venous drainage from it (Carlton & McKean 1977; Johnsen et al. 1985), are as important as our data show.

Dr Janis argues that the rete must have been unimportant because horses are found in the Gobi Desert, and the rete is likely to have evolved prior to the Eocene–Oligocene temperature changes. If the Gobi horses are similar to the feral horses of the Namibian deserts we have studied, then they will be significantly smaller, have lower daily water turnover (Sneddon 1985) and the rete is likely to have evolved prior to the Eocene–Oligocene temperature changes. If the Gobi survivors may well have evolved this function of the rete, while those artiodactyl families that died out were, like tragulids, unable to recruit the rete for thermoregulatory purposes. The absence of the carotid rete in perissodactyls limits their temperature regulation. It seems unreasonable not to conclude, therefore, that the rete may have played a role in artiodactyl success in times of temperature changes to which perissodactyls and other non-rete animals were less well adapted.

In summary, our overall position remains unchanged—‘the carotid rete in conjunction with rumination and locomotion contributed to artiodactyl success’—and are confident that, in time, other helpful adaptations also will be discovered.

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