

Interplay between global patterns of environmental temperature and variation in nonshivering thermogenesis of rodent species across large spatial scales

Enrique Rodríguez-Serrano and Francisco Bozinovic

Abstract

The purpose of this study was to test for correlations of mass-independent nonshivering thermogenesis (NST) in rodent species with climatic factors such as maximum and minimum geographic temperature. We first analyzed whether the responses of rodents show a phylogenetic signal. If so, and if the NST over a broad geographical range is similar, then such responses probably reflect physiological evolutionary adaptation. Our results show that NST did not show phylogenetic signal, appears to be evolutionary labile and is negatively correlated with environmental temperature. We predicted that species evolved in cold climates will exhibit higher mass-independent NST than species from warmer habitats. Indeed, we observed that the relationships between mass-independent NST and minimum temperature ($r_s = -0.411$, $P = 0.009$) as well as between NST and maximum temperature ($r_s = -0.443$, $P = 0.004$) were both negatively and significantly correlated, thus supporting our predictions. Thus, thermal physiology may be a significant factor underlying the ecological and evolutionary success of animals. Finally we suggest that due to the pressing need to explain and predict the likely biological impact of climatic change, advances in this field are necessary.

Keywords: Climate, distribution, endotherms, global change, physiological ecology, thermal tolerances.