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Sleep in the Arabian oryx, Oryx leucoryx

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ABSTRACT

The evolution and function of sleep remains an enigma in modern science. Significant variation can be observed within species and across taxa. Little is understood about how sleep exists, or presents itself in species surviving in extreme conditions. For example, harsh desert ecosystems with notably lower survival rates for resident species. It has been hypothesized that specialized sleep-related behaviours impact thermoregulation to promote survival advantage. The threatened Arabian oryx (*Oryx leucoryx*), a member of the Cetartiodactyl superorder, is a large desert dwelling ungulate species successfully residing in the arid zones of the Middle East. Arabian Oryx exhibit numerous morphophysiological adaptations and capabilities to cope with their harsh environment. The current thesis provides an examination of the neuroanatomy, physiology and behavioural patterns related to sleep in wild, free-roaming Arabian oryx under natural conditions. It was our objective to determine whether the extreme conditions and climate of the Arabian Desert has led to novelties within the organization of the oryx's sleep related neuronal architecture, seasonal behaviour patterns and sleep physiology. Using immunohistochemistry and stereology our results indicate the sleep related nuclei in the brain of the oryx exhibit a typical mammalian organizational plan with additional order-specific and novel, species-specific features. Actigraphy revealed that oryx exhibit temporal niche switching patterns seasonally presenting with winter diurnal- and summer nocturnal activity and intermittent patterns during the transitional periods of spring and autumn. Polysomnography results indicate novel sleep patterns between seasons and physiologically confirm activity-based temporal niche switching at a seasonal level. Our work covers the first examination of the Arabian oryx brain sleep centers as well as its year-long activity patterns. Importantly, it is the first examination of physiological sleep in wild mammals within a desert environment. Our results suggest that ambient temperature acts a dominant driving force for the adaptive behavioural and physiological features described. The Arabian oryx is a remarkable species, well adapted to such an extreme environment and its highly plastic survival mechanisms appear unique. Considering the continual desertification of our planet and the predicted consequences of climate change, knowledge of such species and their continued conservation is of vital importance.

Keywords: Arabian oryx; Sleep; Neuroanatomy; Neurophysiology; Actigraphy; Behaviour; Temperature; Circadian Rhythms; Arabian Desert; Saudi Arabia; Cetartiodactyla