Circadian rhythm in the cardiovascular system of domestic animals

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Abstract

Definition of the temporal characteristics of cardiovascular rhythms is of scientific interest. This article reviews the literature on the rhythmic pattern of some cardiovascular parameters in domestic animals, providing greater understanding of general chrono-biological processes in mammals. The techniques of the chronophysiological studies have been applied in domestic species to determine the existence of periodicity in the cardiovascular functions. Detailed knowledge of these rhythms is useful for clinical, practical and pharmacological purposes and physical performances.

Keywords: Circadian rhythm; Heart rate; Blood pressure; Electrocardiographic parameters; Domestic animals

1. Introduction

Recent research has begun to reveal the complex but very interesting biological basis and ecological usefulness of timing processes within organisms.

A variety of biological variables oscillate in organisms, including behaviour, physiological functions and biochemical factors. If any event within a biological system recurs at approximately regular intervals, we talk about a biological rhythm.

A biological timer can act as an alarm clock to wake up an organism or to initiate a physiological process at an appropriate phase of the daily environmental cycle. It can also help an organism prepare in anticipation of actual need. Another important function in some organisms is the accurate measurement of ongoing time throughout the daily cycle. The circadian clock can act as an instrument for estimating the day length or night length: thus, seasonal phenomena which respond to changing of day length can be regulated appropriately (Dunlap et al., 2004).

Biological rhythms affect a variety of activities, such as the sleep–wake cycle, migration behaviour in birds and seasonal fattening, hibernation, reproductive cycles in wild animals (Piccione and Caola, 2002) and daily biological rhythms are endogenously controlled by self-contained circadian clocks. Circadian implies that under constant external conditions (without time cues) the rhythms free-run with an endogenous period close to but, not identical, to 24 h. Recent evidence indicates that the period length is controlled by a circadian oscillator (clock) (Ikonomov et al., 1998). Several approaches to elucidate the nature of circadian oscillators have emerged over the years (Hastings and Schweiger, 1976; Edmunds, 1994), aimed at locating the anatomical loci responsible for generating these periodicities and tracing the entrainment pathway for light signals from the photoreceptor(s) to the clock itself.

Animals appear to have central clocks that reside in discrete ‘pacemaker tissues’ in the central nervous system, whose signals direct circadian output responses in peripheral tissues areas (Takahashi, 1995).