

## Introduction

by O. Benoit

*Laboratoire de Physiologie, U3 INSERM, 91, Boulevard de l'Hôpital, F-75634 Paris Cedex 13, France*

The influence of the environment on sleep is a vast area for study. The study comprises both the phylogenetic and ontogenetic disciplines and is concerned not only with the alteration of sleep patterns as a function of upbringing and maturation, but also with the effects of geographic and ecological conditions on sleep and their resulting interplay with psychosocial factors.

This review deals only with human sleep. It is necessarily limited to the influence on sleep of the few environmental factors which have been studied, such as noise and temperature. We know practically nothing about the influence of living conditions (urban vs country living, a nomadic vs sedentary existence, etc.) or the influence of climate and latitude on the endogenous sleep-wake process.

As life styles change, the question of the endogenous flexibility of the sleep-wake process becomes more and more important. It is critical to know how sleep-wake cycles can be adapted to modern living which often forces people to work at varying times or stay up for prolonged periods, as for example during transoceanic flights. This question is particularly critical in today's world where greater numbers of people are forced to extend or radically alter their sleep-wake cycles.

As if this were not enough, modern day sleep-wake problems are further exacerbated by factors such as noise, pollution and stress associated with work and crowded living conditions, all of which must be better understood.

Man has no doubt always adapted his sleep-wake cycle to environmental conditions. Among them, the search for a safe place to sleep was of particular importance. Later, the discovery of fire and the development of clothing and housing freed man from the pressures of the external environment. It became possible to take pleasure in sleeping.

Ironically, today we are again confronted by environmental problems, although, as we have noted, they are of an entirely different sort. But in addition, the internalization of existing, environmentally produced daily stress may add another dimension to problems with our sleep-wake cycles.

The first paper by D.S. Minors and J.M. Waterhouse introduces the problem. They describe the exogenous

and endogenous components of the human sleep-wake cycle, and stress the characteristics and the limits of the entrainment by Zeitgebers of the sleep-wake circadian oscillator.

T. Åkerstedt presents the latest data on the influence of work schedules on sleep. He clearly shows that work schedules interfering with normal hours for sleeping generally induce fatigue and subjective/objective sleep disturbances, which are indicative of the limits of adaptability of the biological sleep-wake process to abnormal routines.

J. Foret analyzes the relationships between daytime activity (physical and mental) and subsequent sleep. This article suggests that diurnal activity is able to modulate sleep need and sleep patterns either on a short term or on a long term basis by modifying the internal environment of sleep.

The next two papers deal with the problem of interactions between external conditions (temperature and noise) and sleep. The first paper, by A. Muzet, J.-P. Libert and V. Candas, shows that ambient temperature affects sleep in different ways depending on the balance between thermoregulation control and sleep needs. The results strongly suggest a coupling between the thermoregulatory system and the sleep mechanisms. The second paper by M. Vallet and J. Mouret makes clear that a typical nuisance such as noise is disruptive of sleep and there is little habituation, at least for cardiovascular responses. Unfortunately, we do not yet know if noise experienced during the waking state (for example, on the job or in the everyday surroundings) has a similar disruptive effect.

In the final paper, I present a tentative view of the homeostatic and adaptative role of sleep.

It became strikingly evident, in the course of writing this chapter, how immense the need is for research which will improve our understanding of the roles of genetic and environmental factors involved in a given sleep-wake behavior and the possibilities of different biological sleep-wake processes to adjust to a particular environment.

0014-4754/84/050410-01\$1.50 + 0.20/0  
© Birkhäuser Verlag Basel, 1984

## The sleep-wakefulness rhythm, exogenous and endogenous factors (in man)

by D.S. Minors and J.M. Waterhouse

*Department of Physiology, University of Manchester, Manchester M13 9PT (England)*

### Introduction

Man is a rhythmic creature living in a rhythmic world. Even though the external periodicities to which he is exposed range from years (e.g. sunspot cycle) through an-

nual, monthly (tidal) and daily rhythms, the dominant one shows a period of 24 h in attune with the solar day. Rhythms which follow this period are termed *circadian*. The movements (tropisms) of leaves are in phase with