

SLEEPENING : THE PROCESS OF FALLING ASLEEP

Murray Johns

Sleep Disorders Unit, Epworth Hospital, Richmond, 3121

The process of falling asleep has not received much attention in recent years from physiologists or psychologists. The fact that there isn't a word in the English language for this process may be part of this neglect. I propose to use the term sleeping. I want to review the important features of sleeping, with a plea for further investigation.

The relaxation phase of sleeping begins with behavioural modifications under voluntary control, such as the decision at a particular time to seek and lie down in a physically and psychologically "comfortable" environment (i.e. warm, dark, quiet and non-threatening). Voluntary movements are then inhibited with relaxation, particularly of postural muscles, and closure of the eye lids. The next stage of sleeping involves a complex series of physiological and psychological changes with altered perceptual and cognitive function and less focused attention. Heart rate and blood pressure fall, skin temperature rises by vasodilatation and sweating increases, apart from on the palms and soles where sweating is inhibited. Core temperature falls and cortisol secretion is inhibited temporarily, regardless of what phase of the circadian rhythm sleeping occurs. The pupil constricts and oculomotor control is reduced, with slow, non-conjugate eye movements occurring for a while before ocular quiescence. The auditory, pain, and other sensory thresholds are then increased progressively by active inhibition of sensory pathways in the thalamus.

Alpha waves in the EEG of the relaxed state are blocked quite suddenly as sleeping progresses. There is also a progressive decrease in the occurrence of beta waves, slowing in the frequency of theta waves and the appearance of low-amplitude delta waves in Stage 1 sleep. Vertex sharp waves and a burst for 2 or 3 seconds of high-amplitude theta waves (saw-tooth waves) often precede the first K-complex and spindle of Stage 2 sleep. Sleeping may end here or, more likely, continue for a few minutes until sleep is more established. The cyclical variations of NREM and REM sleep stages then proceed, probably involving different neuronal systems from that of sleeping. The inhibitory processes, begun during sleeping, are maintained and augmented.

Consistencies and variations in the sleeping of different subjects are clearly seen in the graphical summaries of the EEG, EOG and EMG produced by computer analysis at Epworth Hospital. These provide a means of studying sleeping and its failure in insomnia.