

# SLEEP

SLEEP

SLEEP: A recurring state characterized by:

- reduced awareness of, and interaction with, the external environment
- reduced motility and muscular activity
- partial or complete cessation of voluntary behavior and self-consciousness

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- Under normal conditions, sleep occurs in a cyclic manner, termed a circadian rhythm (*circa*: about; *-dies*: day)
- Diurnal animals seep at night and are awake and active during daylight hours.
- The opposite is true of nocturnal animals.
- The sleep-wake cycle is synchronized with the day-night cycle.

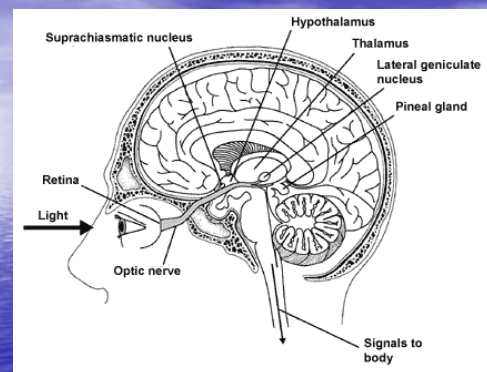
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- As the day-night cycle changes with the seasons, the animals' sleep-wake cycles change also.
- A biological clock, located in the brain, is also involved in sleep-wakefulness cycles.
- Studies have demonstrated that the biological clock in humans tends to run in a consistent sleep-waking cycle of about twenty-five hours.

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- The sleep-wake cycle is ultimately controlled by the brain, specifically by an area with the hypothalamus, the tiny section of the brain that influences the glandular system.
- The inhibitory neuromodulator, adenosine, is thought to be the main sleep inducer.
- Another substance, melatonin, a hormone secreted by the pineal gland, may also play a role.

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- There is also ongoing discussion and research into the role of the neurotransmitter serotonin in the regulation of sleep. As the day goes by, serotonin levels in the nervous system increase and seem to be associated with sleepiness.
- Body temperature also plays a part in inducing sleep.
- However, research on the effects of serotonin and body temperature on sleep is correlational (it cannot yet be assumed that these two factors actually cause sleep to occur.)

## THEORIES OF SLEEP

Why do we sleep? The question remains unanswered.

There are five categories of theories:

- **Humoral (Blood)/Circulatory Theory:**
  - Suggests that sleep is a result of the brain being deprived of its normal amount of oxygen.
- **Restorative or Reparative Theory:**
  - Necessary cellular repairs are made during sleep.
- **Passive Theory - Reticular Hypothesis:**
  - Suggests that sleep results from the cessation of ascending impulses in the ascending reticular activating system.

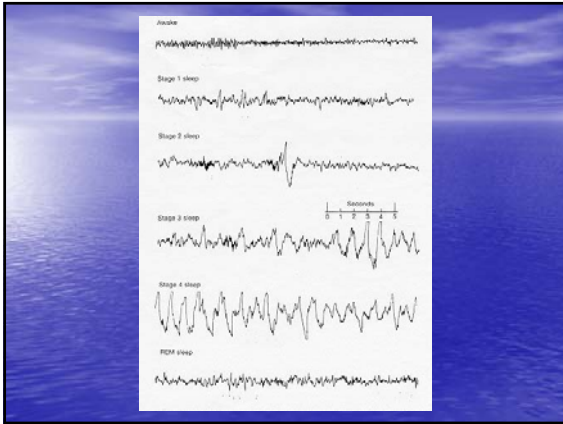
- **Active Theory:**
  - Suggest that sleep is an active process produced by the activation of a sleep-producing system.
- **Adaptive or Evolutionary Theory:**
  - Suggests that sleep is a product of evolution. Sleep evolved as a survival adaptation and/or as a system of conserving energy.

## STAGES OF SLEEP

- Several stages of sleep can be distinguished by their patterns of physiological correlates
- However, it is not possible to identify an exact moment of sleep onset in terms of physiological correlates.
- EEG has been useful in recording neural activity of both waking consciousness and sleep.

### Brain-wave patterns associated with sleep activity:

- **BETA:** 14 - 30 Hz; up to 20 mV amplitude. Normal waking consciousness, alert, excited.
- **ALPHA:** 8 - 13 Hz; 25 - 100 mV amplitude. Awake but in a quiet, resting state with the eyes shut.
- **DROWSY:** Mixed frequencies, 12 - 17 Hz predominate; low voltage. Represents a transition in consciousness between wakefulness and the deeper stages of sleep.
- **THETA:** 4 - 7 Hz; moderately large amplitudes of less than 20 mV. Found in states of meditation, drug intoxication and sleep.
- **DELTA:** 0.5 - 4 Hz; large amplitude. Deep sleep.

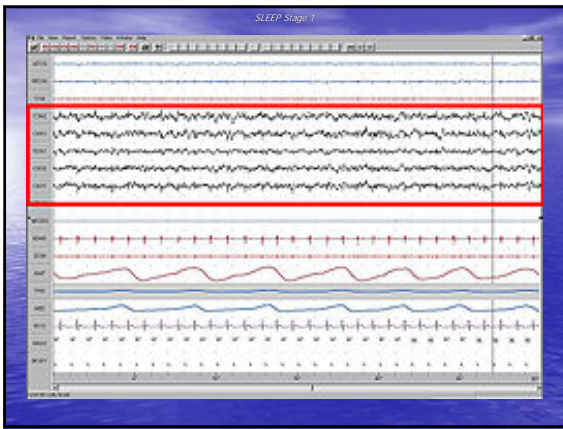


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## FIVE STAGES OF SLEEP

Stage 1: Drowsiness. Brain wave activity is desynchronous, some Alpha.

- Body shows signs of relaxation; muscle tonus diminishes, heart rate slows, and breathing becomes deeper and more regular.



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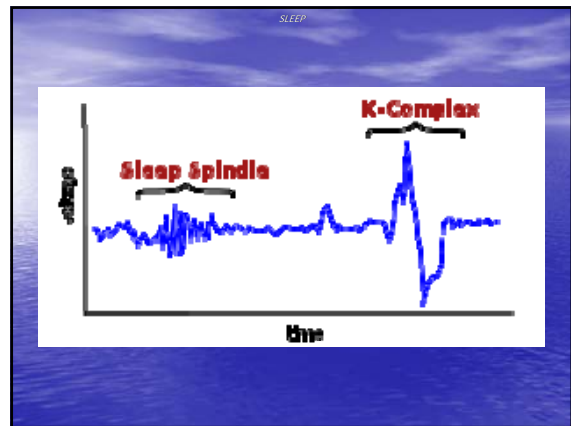
At this stage the individual may also experience vivid visual events called hypnagogic images.

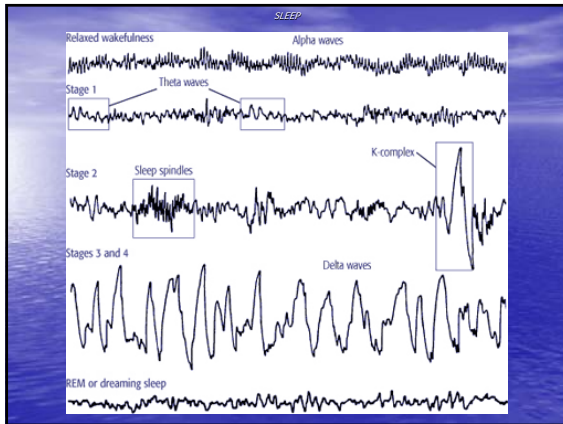
Another common occurrence at this stage is called the hypnic jerk – this occurs as one is drifting off to sleep when the knees, legs, or sometimes the whole body gives a big “jerk.”

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Stage 2: Onset of *sleep spindles* and *k-complexes*. Theta wave activity.

- Associated with the loss of perceptual awareness.
- First indication that the individual has *fallen asleep*.





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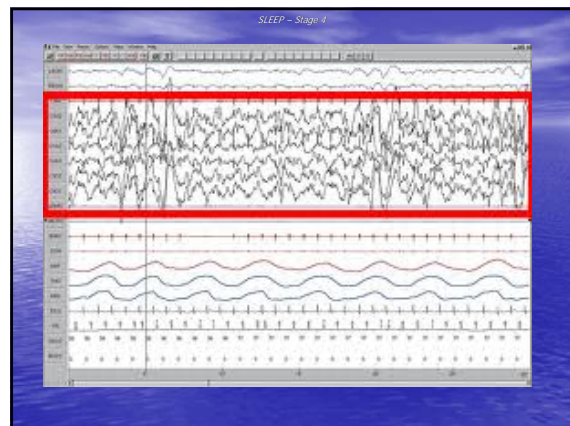
Stage 3: Defined by delta wave activity (20% - 50%).

- All physiological signs, such as muscle tonus, heart rate, blood pressure, and body temperature, show signs of decreasing.
- The individual is soundly asleep and is difficult to awaken.

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Stage 4: Defined by 50% or more delta wave activity. Deep sleep.

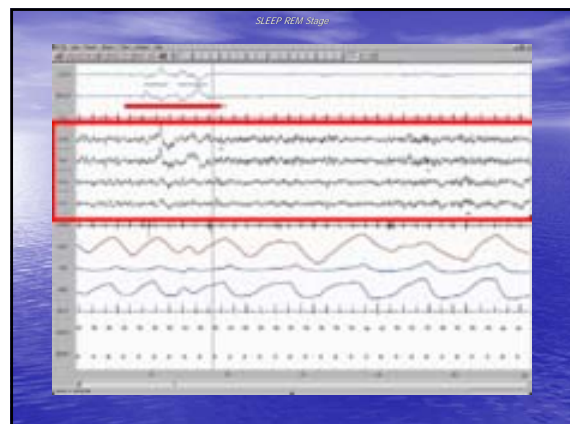
- Individual is very difficult to awaken.
- It is during this stage that growth hormones are released from the pituitary gland and reach their peak.



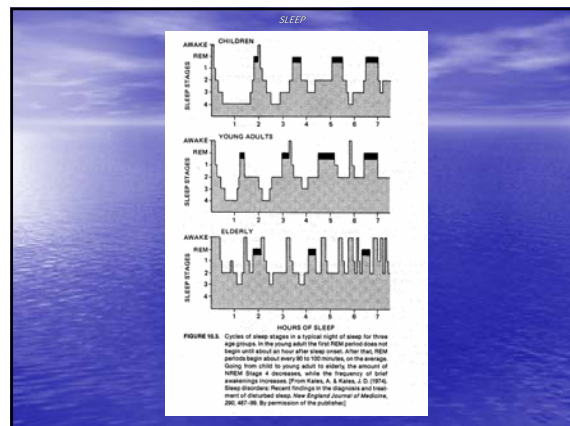
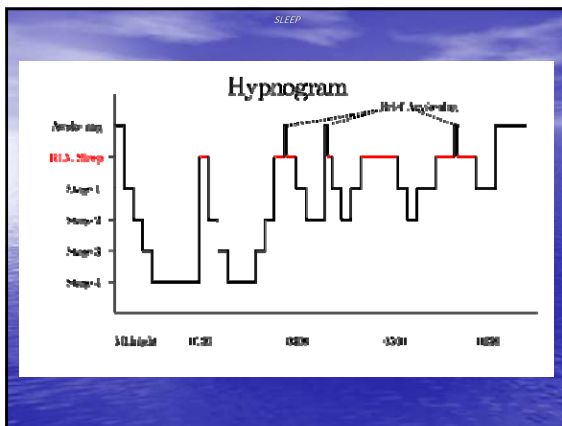
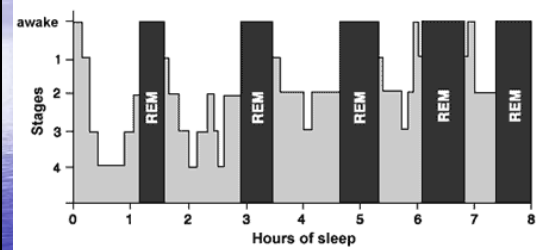
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Rapid Eye Motion (REM) Stage.

- Very similar to Stage 1 sleep, although the individual is much more difficult to arouse.
- Most dreaming is thought to occur during the REM stage of sleep.



- Normal sleep patterns move from 1 -4, and then cycle back: 4, 3, 2, 3, 4...
- Most adults complete a full cycle of sleep stages every 90 - 120 minutes.



### SLEEP DEPRIVATION

- Sleep Deprivation occurs when we have gone without sleep for 24 hours or so.
- It is accompanied by impairment of short-term and possibly, long-term memory.
- When total sleep time is reduced, Stage 4 sleep does not decrease. It may actually increase.
- REM-rebound effect: when subjects are deprived specifically of REM stage sleep, they compensate by entering REM stage more often, as if to make up for lost REM stage sleep.

- Sleep deprivation is often considered a fact of life for many people in our modern environment, especially college students.
- Many people are ignorant of the detrimental effects of sleep deprivation:

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- 55% of drowsy driving fatalities occur under the age of 25.
- 56% of the adult population reports that daytime drowsiness is a problem.
- In a study of 1,000 people who reported no daytime drowsiness, 34% were actually found to be dangerously sleepy.

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- In samples of undergraduates, nurses and medical students, 80% were dangerously sleep deprived.
- Sleep deprivation was one of the factors indicated in such disasters as the explosion of the Challenger space shuttle, the Exxon Valdez oil spill and the Chernobyl disaster.
- 30 – 40% of all heavy truck accidents can be attributed to driver fatigue.

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- Drivers who are awake for 17 to 19 hours were more dangerous than drivers with a blood alcohol level of .05.
- 16 – 60% of road accidents involve sleep deprivation (the size variation is due to the inability to confirm the cause of accidents, as the drivers are often killed.)
- Sleep deprivation is linked to higher levels of stress, anxiety, depression and unnecessary risk taking.

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#### How can you tell if you are sleep deprived?

According to Fahey (1993) you may be sleep deprived if you:

- actually need your alarm clock to wake up.
- find getting out of bed in the morning is a struggle.
- feel tired, irritable, or stressed out for much of the day.

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- have trouble concentrating or remembering.
- fall asleep watching TV, in meetings, lectures, or warm rooms.
- fall asleep after heavy meals or after a low dose of alcohol.
- fall asleep within 5 minutes of getting into bed. (A well-rested person actually takes 15 to 20 minutes to fall asleep.)



