

SLEEP

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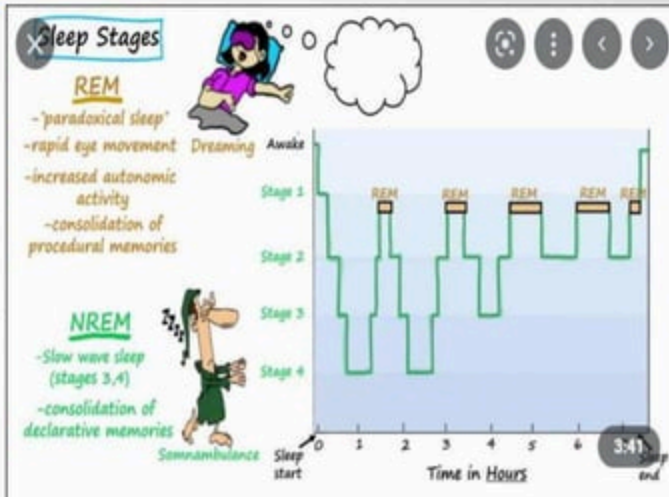


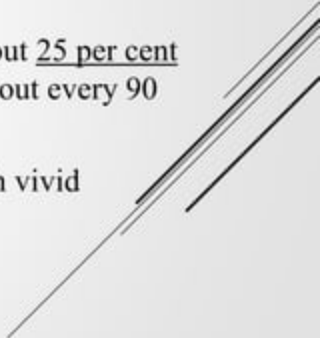
- ▶ **Sleep** is defined as unconsciousness from which the person can be aroused by sensory or other stimuli.
- ▶ It is to be distinguished from coma, which is unconsciousness from which the person cannot be aroused.



► Sleep can be broadly divided into 2 types-

- During each night, a person goes through stages of two types of sleep that alternate with each other.
- They are called
- (1) slow-wave sleep, because in this type of sleep the brain waves are very strong and very low frequency, and
- (2) rapid eye movement sleep (REM sleep), because in this type of sleep the eyes undergo rapid movements despite the fact that the person is still asleep.



- ▶ Most sleep during each night is of the slow-wave variety; this is the deep, restful sleep that the person experiences during the first hour of sleep after having been awake for many hours.
 - ▶ REM sleep, on the other hand, occurs in episodes that occupy about 25 per cent of the sleep time in young adults; each episode normally recurs about every 90 minutes.
 - ▶ This type of sleep is not so restful, and it is usually associated with vivid dreaming.
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- ▶ **Slow-Wave Sleep** - Most of us can understand the characteristics of deep slow-wave sleep by remembering the last time we were kept awake for more than 24 hours and then the deep sleep that occurred during the first hour after going to sleep.
- ▶ This sleep is exceedingly restful and is associated with decrease in both peripheral vascular tone and many other vegetative functions of the body.
- ▶ For instance, there are 10 to 30 per cent decreases in blood pressure, respiratory rate, and basal metabolic rate.
- ▶ Although slow-wave sleep is frequently called “dreamless sleep,” dreams and sometimes even nightmares do occur during slow-wave sleep.

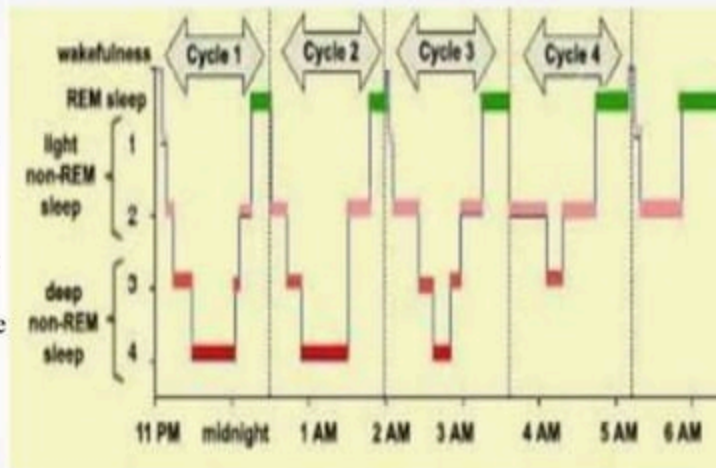


- ▶ The difference between the dreams that occur in slow-wave sleep and those that occur in REM sleep is that those of REM sleep are associated with more bodily muscle activity, and the dreams of slow-wave sleep usually are not remembered.
- ▶ That is, during slow-wave sleep, consolidation of the dreams in memory does not occur.



► **REM Sleep (Paradoxical Sleep, Desynchronized Sleep)-**

- In a normal night of sleep, bouts of REM sleep lasting 5 to 30 minutes usually appear on the average every 90 minutes.
- When the person is extremely sleepy, each bout of REM sleep is short, and it may even be absent. Conversely, as the person becomes more rested through the night, the durations of the REM bouts increase.



► **There are several important characteristics of REM sleep:**

1. It is usually associated with active dreaming and active bodily muscle movements.
2. The person is even more difficult to arouse by sensory stimuli than during deep slow-wave sleep,
3. Muscle tone throughout the body is exceedingly depressed, indicating strong inhibition of the spinal muscle control areas.
4. Heart rate and respiratory rate usually become irregular, which is characteristic of the dream state.
5. Despite the extreme inhibition of the peripheral muscles, irregular muscle movements do occur. These are in addition to the rapid movements of the eyes



6. The brain is highly active in REM sleep, and overall brain metabolism may be increased as much as 20 per cent. The electroencephalogram (EEG) shows a pattern of brain waves similar to those that occur during wakefulness.
7. This type of sleep is also called paradoxical sleep because it is a paradox that a person can still be asleep despite marked activity in the brain.

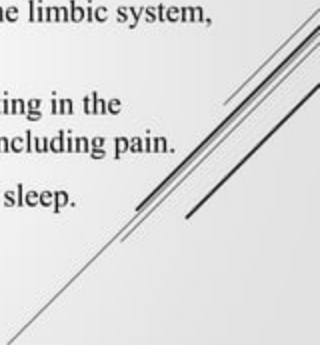
The Sleep Cycle

NREM Sleep			REM Sleep
Stage 1	Stage 2	Stage 3	Stage R
4-7 Hours per Night			90-120 minutes per Night

The infographic features a light blue background with decorative elements like stars and a moon. At the top right, there are navigation icons: a close button (X), a search icon, a menu icon (three dots), and a back arrow. The table is presented in a clean, modern style with a color gradient from light purple to dark blue for the NREM Sleep header.

- ▶ Basic Theories of Sleep-
- ▶ Sleep Is Believed to Be Caused by an Active Inhibitory Process.
- ▶ Neuronal Centers, Neurohumoral Substances, and Mechanisms That Can Cause Sleep— A Possible Specific Role for Serotonin-
- ▶ The most conspicuous stimulation area for causing almost natural sleep is the raphe nuclei in the lower half of the pons and in the medulla.





- ▶ Nerve fibers from these nuclei spread locally in the brain stem reticular formation and also upward into the thalamus, hypothalamus, most areas of the limbic system, and even the neocortex of the cerebrum.
 - ▶ In addition, fibers extend downward into the spinal cord, terminating in the posterior horns where they can inhibit incoming sensory signals, including pain.
 - ▶ serotonin is a transmitter substance associated with production of sleep.
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▶ **Lesions in Sleep-Promoting Centers Can Cause Intense Wakefulness-**

- ▶ Discrete lesions in the raphe nuclei lead to a high state of wakefulness.
- ▶ the excitatory reticular nuclei of the mesencephalon and upper pons seem to become released from inhibition, thus causing the intense wakefulness.
- ▶ **Possible Cause of REM Sleep-** Why slow-wave sleep is broken periodically by REM sleep is not understood. However, drugs that mimic the action of acetylcholine increase the occurrence of REM sleep.

▶ **Cycle Between Sleep and Wakefulness-**

- ▶ When the sleep centers are not activated, the mesencephalic and upper pontine reticular activating nuclei are released from inhibition, which allows the reticular activating nuclei to become spontaneously active.
 - ▶ This in turn excites both the cerebral cortex and the peripheral nervous system, both of which send numerous positive feedback signals back to the same reticular activating nuclei to activate them still further.
 - ▶ Therefore, once wakefulness begins, it has a natural tendency to sustain itself because of all this positive feedback activity
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- ▶ After the brain remains activated for many hours, even the neurons themselves in the activating system presumably become fatigued.
 - ▶ Consequently, the positive feedback cycle between the mesencephalic reticular nuclei and the cerebral cortex fades, and the sleep-promoting effects of the sleep centers take over, leading to rapid transition from wakefulness back to sleep.
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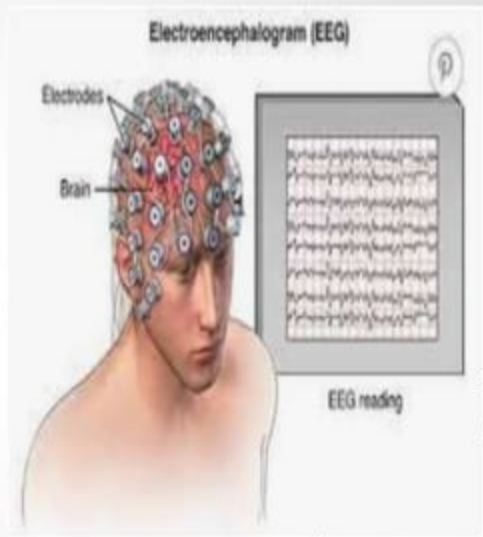
▶ **Physiologic Effects of Sleep** - Sleep causes two major types of physiologic effects:

1. first, effects on the nervous system itself, and
 2. second, effects on other functional systems of the body.
- ▶ Lack of sleep certainly does, however, affect the functions of the central nervous system.
 - ▶ Prolonged wakefulness is often associated with progressive malfunction of the thought processes and sometimes even causes abnormal behavioral activities.

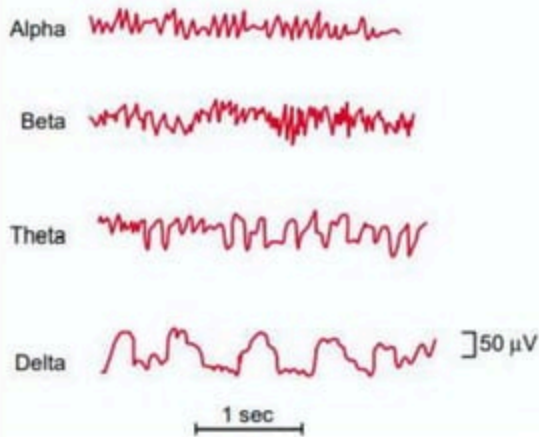


▶ Brain Waves-

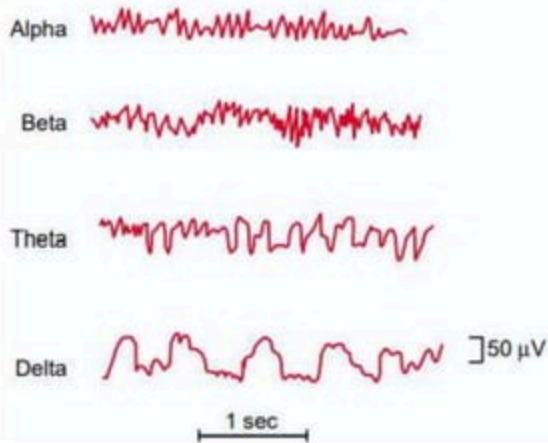
- ▶ Electrical recordings from the surface of the brain or even from the outer surface of the head demonstrate that there is continuous electrical activity in the brain.
- ▶ The undulations in the recorded electrical potentials are called brain waves, and the entire record is called an EEG (electroencephalogram)



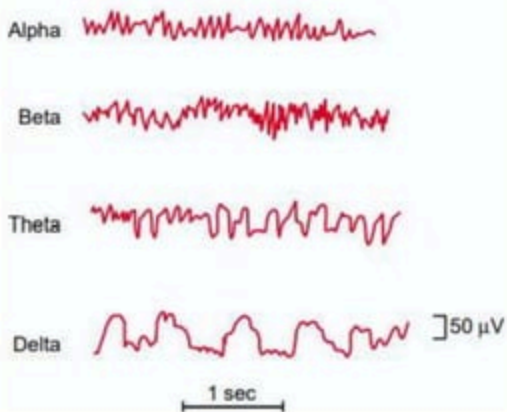
- ▶ Alpha waves are rhythmical waves that occur at frequencies between 8 and 13 cycles per second and are found in the EEGs of almost all normal adult people when they are awake and in a quiet, resting state of cerebration.
- ▶ These waves occur most intensely in the occipital region but can also be recorded from the parietal and frontal regions of the scalp.
- ▶ Their voltage usually is about 50 microvolts. During deep sleep, the alpha waves disappear.



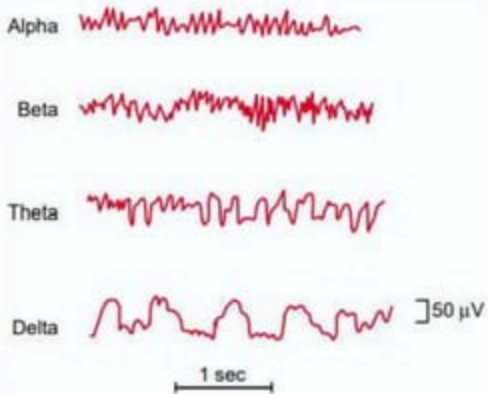
- When the awake person's attention is directed to some specific type of mental activity, the alpha waves are replaced by asynchronous, higher-frequency but lower-voltage beta waves.
- This is also called Alpha block. The term *aroused or alerting response* is also used to denote a block.
- The term desynchronization has also been suggested for a block
- ▶ Beta waves occur at frequencies greater than 14 cycles per second and as high as 80 cycles per second.
- ▶ They are recorded mainly from the parietal and frontal regions during specific activation of these parts of the brain.



- ▶ Theta waves have frequencies between 4 and 7 cycles per second.
- ▶ They occur normally in the parietal and temporal regions in children, but they also occur during emotional stress in some adults, particularly during disappointment and frustration.
- ▶ Theta waves also occur in many brain disorders, often in degenerative brain states.



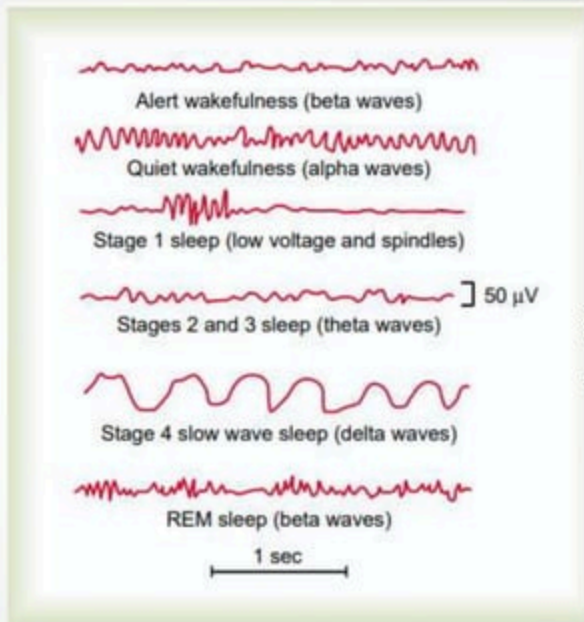
- ▶ Delta waves include all the waves of the EEG with frequencies less than 3.5 cycles per second, and they often have voltages two to four times greater than most other types of brain waves.
- ▶ They occur in very deep sleep, in infancy, and in serious organic brain disease.



Changes in the EEG at Different Stages of Wakefulness and Sleep-

Alert wakefulness is characterized by high-frequency beta waves,

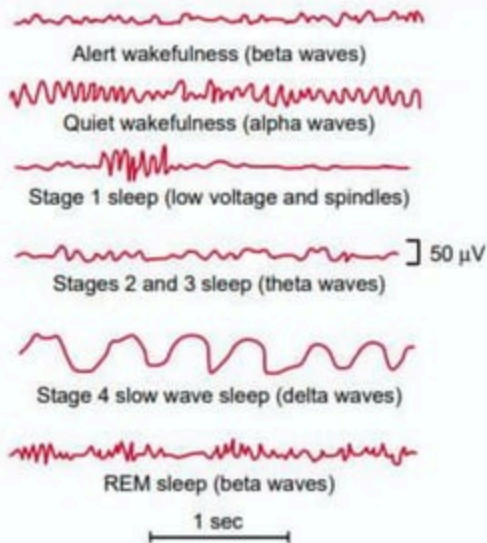
whereas quiet wakefulness is usually associated with alpha waves, as demonstrated by the first two EEGs of the figure.



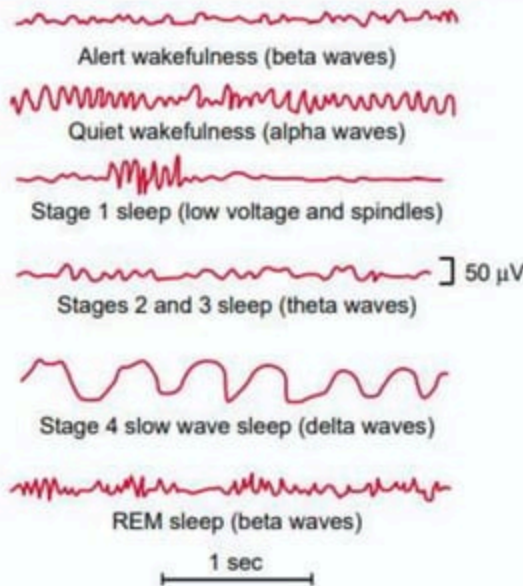
Slow-wave sleep is divided into four stages-

In the first stage, a stage of very light sleep, the voltage of the EEG waves becomes very low; this is broken by "sleep spindles," that is, short spindle-shaped bursts of alpha waves that occur periodically.

In stages 2, 3, and 4 of slow-wave sleep, the frequency of the EEG becomes progressively slower until it reaches a frequency of only 1 to 3 waves per second in stage 4; these are delta waves.



- ▶ Finally, the record in Figure shows the EEG during REM sleep.
- ▶ It is often difficult to tell the difference between this brain wave pattern and that of an awake, active person.
- ▶ The waves are irregular and high-frequency, which are normally suggestive of desynchronized nervous activity as found in the awake state.
- ▶ Therefore, REM sleep is frequently called desynchronized sleep because there is lack of synchrony in the firing of the neurons, despite significant brain activity.



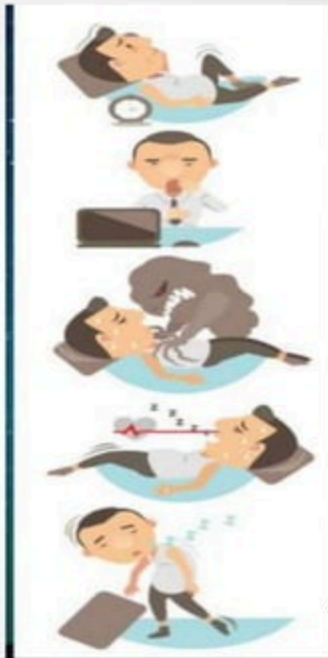
► **SLEEP DISORDERS-**

- 1. Insomnia refers to an inability to have sufficient or restful sleep despite an adequate opportunity for sleep.
- 2. Narcolepsy refers to an irresistible urge to sleep.



Sleep disorders associated with non-REM sleep (slow wave sleep)-

1. **Sleep walking (somnambulism)-**
Episodes of sleep walking are more common in children than in adults.
2. **Bed-wetting (nocturnal enuresis),** i.e. involuntary voiding of urine, occurs in some children during slow wave sleep.
3. **Nightmares (pavor nocturnus** or episodes of night terror). During a nightmare that occurs in slow wave sleep, an individual wakes up screaming screaming and appears terrified.





END

