

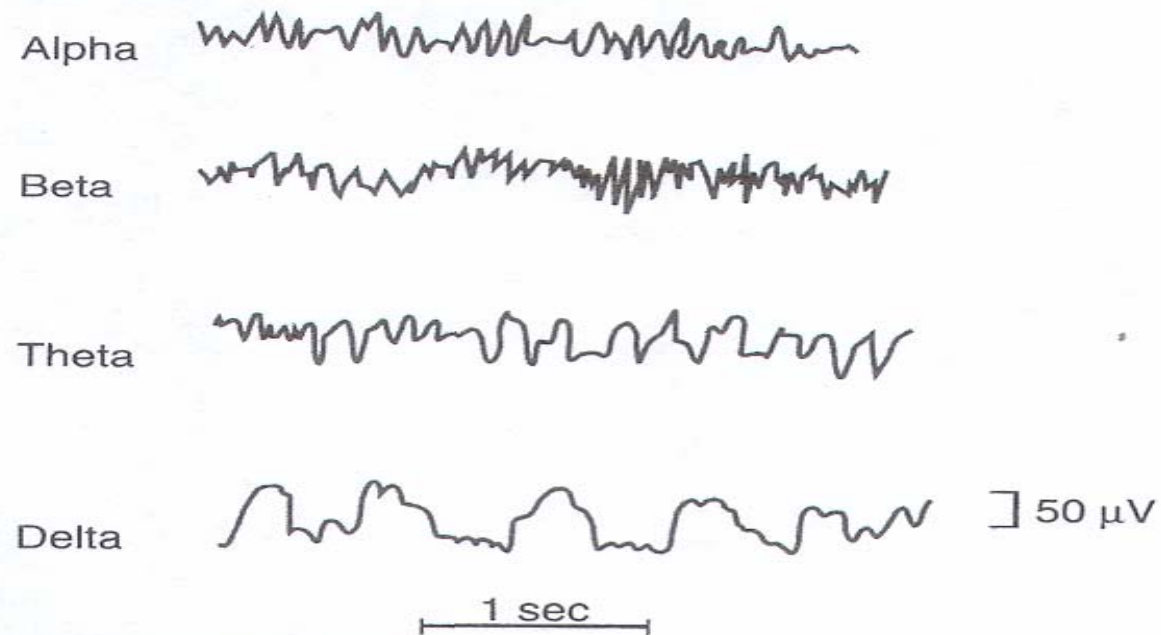
# Sleep

- Electrical recordings from the surface of the brain & from outer surface from the head demonstrate that there is continuous electrical activity in the brain
- Both the intensity & patterns of this electrical activity are determined to a great extent by the level of excitation of the brain resulting from:
  - Sleep
  - Wakefulness
  - Brain diseases
  - Epilepsy
  - Some psychoses

# Sleep

- Much of the time, the brain waves are irregular & no general pattern can be discerned in EEG
- At other times distinct patterns appear
  - Some of these distinct patterns are characteristic of specific abnormalities of the brain like epilepsy
- Other specific types of waves occur even in normal healthy people
- Most are classified as:
  - Alpha
  - Beta
  - Theta
  - Delta

# Sleep



**FIGURE 59 - 1**

Different types of waves in the normal electroencephalogram.

	Alpha Waves	Beta Waves	Theta Waves	Delta Waves
Frequency (cycles)	8-13	14-80	4-7	<3.5
Voltage level	50 microvolts			2-4 x higher other brain waves
Location	Occipital mostly, parietal, frontal	Parietal & frontal	Parietal & temporal in children	
Activities	Awake, quiet resting state of cerebration	Tension, extra activation of CNS	Emotional stress, disappointment, frustration	Very deep sleep, in infancy, serious brain disease
Status	Normal		Also seen in many brains disorders, Degenerative brain states	

Textbook of Medical Physiology 10th edition Guyton & Hall p689-693

# Sleep

## Changes in the EEG at Different Stages of Wakefulness & Sleep

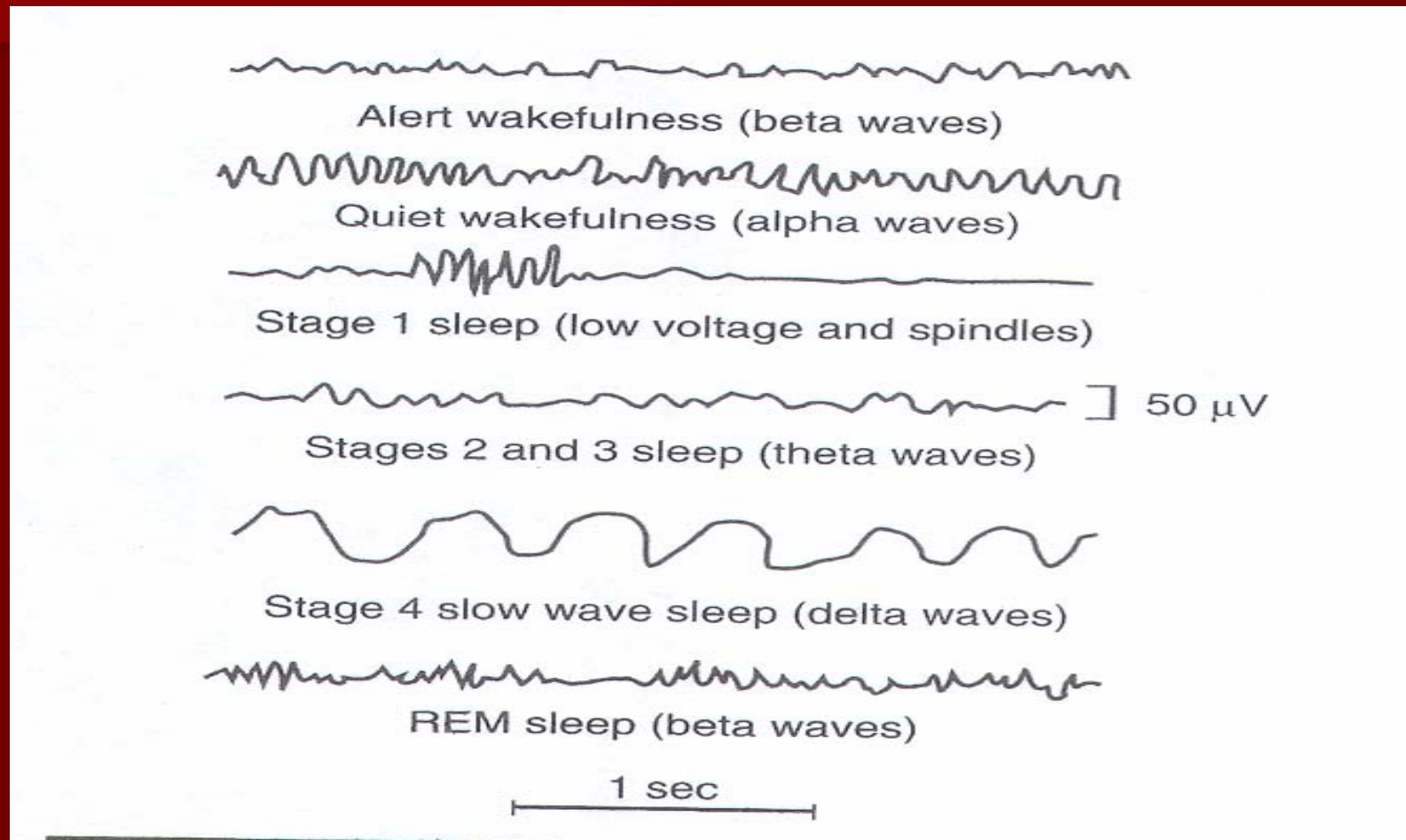
- Slow wave sleep is divided into four stages
- In the first stage a stage of very light sleep, the voltage of the EEG waves becomes very low
  - This is broken by sleep spindles
- Short spindle shaped bursts of alpha waves that occur periodically
- In stages 2, 3, & 4 of slow wave sleep, the frequency of the EEG becomes progressively slower until it reaches a frequency of only 1-3 waves per second in stage 4
  - These are typically delta waves

# Sleep

## Changes in the EEG at Different Stages of Wakefulness & Sleep

- Finally, the bottom record in figure 59-4 shows the EEG during REM sleep
- It is often difficult to tell the difference between this brain wave pattern & that of an alert awake person
- The waves are irregular high frequency beta waves, which are normally suggestive of excess but desynchronized nervous activity as found in the awake state
- Therefore, REM sleep is frequently called desynchronized sleep because there is a lack of synchrony in the firing of the neurons, despite significant brain activity

# Progressive Changes in the Characteristics of Brain Wave during Different Stages of Wakefulness & Sleep Figure 59-4



# Sleep

## Slow Wave Sleep

- Brain waves are very large but very slow
- Most sleep during each night
- Deep restful sleep
- Occurs during the first hour of sleep after being awake for many hours
- Associated c:
  - ↓ peripheral vascular tone
  - 10-30% ↓ in } BP
  - RR
  - Basal Metabolic Rate

# Sleep

## REM

- The eyes undergo rapid movements despite the person being asleep
- Occurs in episodes
- Occupies about 25% of sleep time in young adult
- Each episode normally recurs about every 90 minutes
- Type of sleep not so restful
- Usually associated with vivid dreaming

# Sleep

## REM

- Bouts occur lasting 5-30 min every 90 minutes on average
- If extremely sleep each bout of REM is short or can be absent
- As one becomes more rested through the night, the duration of REM bouts greatly increase
- Several important characteristic of REM sleep
  - Usually associated active dreaming & active bodily muscle movements
  - One is more difficult to arouse by sensory stimuli than during slow wave sleep

# Sleep

## REM

- Muscle tone throughout body is exceedingly depressed
  - Indicates strong inhibition of spinal muscle control areas
- Heart rate and RR usually become irregular
- Characteristic of dream state
- Despite the extreme inhibition of the peripheral muscles, irregular muscle movement do occur

## Paradoxical sleep

- Brain is highly active in REM
  - Brain metabolism may be ↑ as much as 20%

# Sleep

## Physiologic Effects of Sleep

- Sleep causes two major types of physiologic effects:
  - 1. Effects on the nervous system itself
  - 2. Effects on other functional systems of the body

# Sleep

## Physiologic Effects of Sleep

### Somatic System Effects

- Conversely, during slow wave sleep, sympathetic activity decreased while parasympathetic activity ↑
- Therefore, a “restful” sleep ensues:
  - ↓ Arterial BP
  - ↓ Pulse rate

# Sleep

## Physiologic Effects of Sleep

### Somatic System Effects

- Skin vessels dilate
- GI activity sometimes ↑
- Skeletal muscles fall into a mainly relaxed state
- ↓ Basal metabolic rate by 10-30%