At the end of this topic you will learn about:

1. Describe the physiological mechanisms of sleep and waking
2. Describe the physiological and behavioral description of sleep
3. Discuss the neural control of slow-wave and REM sleep.
4. Describe circadian rhythms and discuss research on the role of the suprachiasmatic nucleus in the control of these rhythms.
5. Discuss the time base of the circadian clock, control of seasonal rhythms, and changes in circadian rhythms caused by work schedules and travel.
6. Explain why do we sleep?
7. Discuss insomnia, sleeping medications, and sleep apnea.
8. Discuss narcolepsy and problems associated with REM and slow-wave sleep.
9. Review the hypothesis that sleep serves as a period of restoration by discussing the effects of sleep deprivation, exercise, and mental activity.
10. Evaluate evidence that the onset and amount of sleep is chemically controlled, and describe the neural control of arousal.
A PHYSIOLOGICAL AND BEHAVIORAL DESCRIPTION OF SLEEP

7.1.1 Stages of Sleep

The stages of non-REM sleep — stages 1 through 4 — are defined. The two principal explanations for sleep are that sleep serves as an adaptive response or that it provides a period of restoration. This is supported by studies using sleep deprivation. In humans, sleep deprivation impairs cerebral functioning. Animals that are sleep-deprived eventually die.

Slow-wave sleep does indeed reduce the brain’s metabolic rate and that increased mental activity can cause an increase in slow-wave sleep the next night. REM sleep may promote brain development and learning.

Sleep-promoting substances or wakefulness-promoting substances may exist. Adenosine, released when neurons are obliged to utilize the supply of glycogen stored in astrocytes, serves as the link between increased brain metabolism and the necessity of sleep.

Four systems of neurons appear to be important for active wakefulness: the acetylcholinergic system (cortical activation); the noradrenergic system (vigilance); the serotonergic system (automatic behaviors such as locomotion and grooming); and the histaminergic neurons (cortical activation).

Antonia (muscular paralysis that prevents our acting out our dreams) is produced by a group of acetylcholinergic neurons. Sleep is related to temperature; it normally occurs only after the brain temperature has been lowered.

Sleep disturbances and disorders include: insomnia, sleep apnea, narcolepsy, sleep attacks, cataplexy, sleep paralysis, hypnagogic hallucinations, and REM without atonia. During slow-wave sleep, some people are afflicted by bedwetting (nocturnal enuresis), sleepwalking (somnambulism), or night terrors (pavor nocturnus).

Stage 1: A transition period of drowsiness between waking and sleeping; sleep spindles occur.
Stage 2: Somewhat more deeply asleep; delta waves slight
Stage 3: Slow wave sleep begins; delta waves reach 20%.
Stage 4: Delta waves reach nearly 100%.
Stage 1

- Similar to awake EEG, but slower
- Low-voltage, high-frequency
- EEG voltage increases and frequency decreases as one progresses from stage 1 through 2, 3, and 4

Stage 2

- K complexes – large negative waves
- Sleep spindles – burst of 12-14 Hz waves
- Stages 3 and 4 – delta waves, large and slow
- Progress to stage 4 sleep and then retreat to stage 1

Emergent stage 1 differs from initial stage 1:

- REMs
- Loss of body core muscle tone
- Progress through sleep stages in 90 minute cycles
- More time spent in emergent stage 1 as night progresses
- Emergent stage 1 sleep = REM sleep
- Non-REM (NREM) sleep = all other stages

Stage 3 + 4 = slow-wave sleep (SWS)

During REM:

- REMs
- Loss of core muscle tone
- Low-amplitude/high-frequency EEG
- Increased cerebral and autonomic activity
- Muscles may twitch

NREM Sleep (Non-rapid eye movement sleep)

Four sleep stages

- Lightest sleep
- Mid-sleep
- Deep sleep
- Deepest sleep

Heart and respiration slow and regular.
Little body movement.
Blood pressure and brain activity at lowest points of 24 hour period.

Non-REM sleep: All stages of sleep are non REM, except REM sleep.

REM sleep: A period of desynchronized EEG activity during sleep, at which time dreaming, rapid eye movements, and muscular paralysis occur.
80% of awakenings from REM yield reports of story-like dreams
**Slow-wave sleep:** Non-REM sleep, characterized by synchronized EEG activity during deeper stages.

**Basic rest-activity cycle**
A 90-minute cycle (in humans) of waxing and waning alertness, controlled by a biological clock in the caudal brain stem; controls cycles of REM sleep and slow-wave sleep. Rapid eye movement sleep called “active sleep”; 20-25% of a night’s sleep.

**Internally:**
- Intense brain activity
- Brain metabolism increases
- Brain temperature rises rapidly
- Epinephrine release leads to increases in
  - Blood pressure
  - Heart rate
  - Respiration

**Externally:**
- Body appears calm
- Large muscles become paralyzed
- Eyes dart around

**REM Rebound**
The increased amount of REM sleep that occurs after REM deprivation; intensity of REM sleep increases. Those with sleep deprivation proceed more rapidly into REM as REM deprivation increases. More time spent in REM when deprivation is over and is often associated with unpleasant dreams or nightmares.

Alcohol, amphetamines, cocaine, and LSD use suppress REM sleep results in REM rebound. Withdrawal results in REM rebounds; REM rebound suggests that REM sleep serves a special function.

**7.1.2 Physiological Measures of Sleep**

1. **By means of Electroencephalogram (EEG)** - “brain waves”.
2. **By means of EOG** - Eye movements seen during rapid eye movement (REM) sleep.
3. **By means of EMG** - Loss of activity in neck muscles during some sleep stages.

**Electro-oculogram (EO):** An electrical potential from the eyes, recorded by means of electrodes placed on the skin around them; detects eye movements.

**Electromyogram (EMG):** An electrical potential recorded from an electrode placed on a muscle.

**Polysomnogram:** Provides brain wave sleep recordings; outlined REM and NREM sleep patterns.
Electroencephalogram (EEG)

- **Beta activity**: Irregular electrical activity of 13–30 Hz recorded from the brain; generally associated with a state of arousal.
- **Alpha activity**: A smooth electrical activity of 8–12 Hz recorded from the brain; generally associated with a state of relaxation; eyes closed, preparing to sleep.
- **Theta activity**: EEG activity of 3.5–7.5 Hz that occurs intermittently during early stages of slow-wave and REM sleep.
- **Delta activity**: Regular, synchronous electrical activity of less than 4 Hz recorded from the brain; occurs during the deepest stages of slow-wave sleep.

### 7.1.3 Dreams

Dream content varies by culture, gender, and age; frequently connects with recent experience and may help us form memories.

**REM Dream**: An almost continually occurring dream during REM sleep; has story like qualities; more vivid, visual, and emotional than NREM dreams.

**NREM Dream**: Less frequent than REM dreams; less memorable than REM dreams

**Bizarre Dreams**: Caused by lower amounts of serotonin and norepinephrine lead to less inhibition of impulsive thoughts and actions.

**Lucid Dreams**: A dream an individual is aware of dreaming and whose content the individual is often able to influence while dreaming.

**Interpreting Dreams**

Sigmund Freud thought dreams were triggered by unacceptable repressed wishes. He believed dreams satisfy unconscious sexual and aggressive desires and so must be disguised.

- **Manifest Content**: The content of a dream as recalled by the dreamer
- **Latent Content**: The underlying meaning of the dream

In recent years, it has been seen as an expression of a broad range of the dreamer’s concerns rather than sexual impulses.

**Activation-Synthesis Hypothesis**

Dreams are the brain’s attempt to make sense of the random firing of brain cells during sleep. Cortex creates a story in an effort to make sense of the brain’s activity. Story is synthesized as a consequence of brain activity.
7.2 WHY DO WE SLEEP?

7.2.1 Recuperation theories

Recuperative theories state that sleep is needed to restore homeostasis and wakefulness causes a deviation from homeostasis.

7.2.2 Circadian theories

Circadian rhythms — those with a period of approximately one day — are controlled by biological clocks in the brain. Light serves as a zeitgeber for most circadian rhythms. Circadian theories state that sleep is the result of an internal timing mechanism and has evolved to protect us from the dangers of the night.

Circadian theory of sleep is based on the premise that sleep evolved to keep humans out of harm’s way during the dark of night and possibly from becoming prey of some nocturnal predator.

7.2.3 Comparative Analysis of Sleep

All mammals and birds sleep, therefore it must have an important function. However, it is not a special higher-order human function and not necessarily needed in large quantities. There is no clear relationship between species’ sleep time and activity level.

7.2.4 Restorative theory

Restorative theory holds that being awake produces wear and tear on the body and brain, and sleep serves the function of restoring the body and mind.

7.2.5 Default Theory of REM

REM serves no critical function, one can’t stay continuously in non-REM sleep, so we switch between REM and wakefulness. When bodily needs exist, we wake up; if there are no immediate needs we remain in REM. No REM rebound seen when lost REM periods replaced with 15-mins awake.
7.3 PHYSIOLOGICAL MECHANISMS OF SLEEP AND WAKING

7.3.1 Neural Control of Arousal

Circuit of neurons that secrete at least five different neurotransmitters play a role in some aspect of an animal’s level of alertness and wakefulness – what is commonly called arousal: acetylcholine, norepinephrine, serotonin, histamine, and hypocretin.

**Acetylcholine**

One of the most important neurotransmitters involved in arousal. Two groups of acetylcholinergic neurons located in the pons and basal forebrain. They produce activation and cortical desynchrony when they are stimulated.

**Norepinephrine**

Catecholamine agonists produce arousal and sleeplessness; effects appear to be mediated by the locus coeruleus in the dorsal pons. Neurons of the locus coeruleus give rise to axons that branch widely, releasing norepinephrine throughout the neocortex, hippocampus, thalamus, cerebellar cortex, pons, and medulla.

![Figure 7.1: Activity of noradrenergic neurons in the locus coeruleus.](image)
Figure 7.2: A section through the pons of a rat, showing the location of the locus coeruleus, which contains the cell bodies of most of the brain’s noradrenergic neurons. Also shown are some structures that play a role in REM sleep.

**Locus coeruleus:** A dark color group of noradrenergic cell bodies located in the pons near the rostral end of the floor of the fourth ventricle; involved in arousal and vigilance.

Figure 7.3:
Activity of serotogenic (5-HT-secreting) neurons in the dorsal raphe nuclei of freely moving cats during various stages of sleep and waking.
Histamine

A neurotransmitter implicated in the control of wakefulness and arousal; a compound synthesized from histidine, an amino acid.

Serotonin (5-HT)

Appears to play a role in activating behavior; almost all of the brain’s serotonergic neurons are found in the raphe nucleus. These neurons are located in the medullary and pontine regions of the brain.

Raphe nucleus: A group of nuclei located in the reticular formation of the medulla, pons, and midbrain, situated along the midline; contains serotonergic neurons.

Tuberomammillary nucleus: A nucleus in the ventral posterior hypothalamus, just rostral to the mamillary bodies; contains histaminergic neurons involved in cortical activation and behavioral arousal.

Hypocretin

A peptide also known as orexin, produced by neurons whose cell bodies are located in the hypothalamus; their destruction causes narcolepsy.

7.3.2 Neural Control of Slow-Wave Sleep

Ventrolateral preoptic area (VLPA): A group of GABAergic neurons in the preoptic area whose activity suppresses alertness and behavioral arousal and promotes sleep. Destruction of this area has been reported to result in total insomnia, coma, and eventual death in rats.

Figure 7.4: A schematic diagram of the effect of activation of the hypocretinergic system of neurons of the lateral hypothalamus on the sleep/waking flip-flop. Motivation to remain awake or events that disturb sleep activate the hypocretinergic neurons.
7.3.3 Neural Control of REM Sleep

**PGO wave (pontine, geniculate, occipital):** Bursts of phasic electrical activity originating in the pons, followed by activity in the lateral geniculate nucleus and visual cortex, a characteristic of REM sleep.

**The Executive Mechanism**

**Peribrachial area:** The region around the brachium conjunctivum, located in the dorsolateral pons; contains acetylcholinergic neurons involved in the initiation of REM sleep.

**Carbachol:** A drug that stimulates acetylcholine receptors.

**Medial pontine reticular formation (MPRF):** A region that contains neurons involved in the initiation of REM sleep; activated by acetylcholinergic neurons of the peribrachial area. Similarities between REM and wakefulness suggest that the same brain area might be involved in both. REM sleep is controlled by nuclei in the caudal reticular formation, each controlling a different aspect of REM.

**Magnocellular nucleus:** A nucleus in the medulla; involved in the atonia (muscular paralysis) that accompanies REM sleep.

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**Figure 7.5:** A summary of the neural circuitry that is thought to be responsible for the components of REM sleep.
7.4 BIOLOGICAL CLOCKS

7.4.1 Circadian Rhythms and Zeitgebers

Circadian Rhythm: A daily rhythmical change in behavior or physiological process. Regular fluctuation from high to low points of certain bodily functions and behaviors.

Sleep debt: Deficiency caused by not getting the amount of sleep that one requires for optimal functioning. Affects psychological functions of:

- Blood pressure
- Heart rate
- Appetite
- Secretion of hormones and digestive enzymes
- Sensory acuity
- Elimination
- Body’s response to medication

7.4.2 Suprachiasmatic Nucleus

Suprachiasmatic nucleus (SCN): A nucleus, situated atop the optic chiasm, in the brain’s hypothalamus that control the timing of circadian rhythms. It contains a biological clock responsible for organizing many of the body’s circadian rhythms.

Lesions do not reduce sleep time, but they abolish its circadian periodicity; exhibit activity that can be entrained by the light-dark cycle.

Melanopsin: A photopigment present in ganglion cells in the retina whose axons transmit information to the SCN, the thalamus, and the olivary pretectal nuclei.

Zeitgebers: A stimulus (usually the light of dawn) that resets the biological clock responsible for circadian rhythms; synchronizes the endogenous system.
Intergeniculate leaflet (IGL): A part of the lateral geniculate nucleus that receives information from the retina and projects to the SCN; terminals release neuropeptide Y at the SCN.

7.4.3 Control of Seasonal Rhythms

Pineal Gland: A gland attached to the dorsal tectum; produces melatonin and plays a role in circadian and seasonal rhythms. Secretes melatonin from dusk until just before dawn; does not secrete melatonin during daylight hours.

Melatonin: A hormone synthesized from serotonin in the pineal gland. Melatonin levels display circadian rhythms controlled by the SCN plays a role in circadian and seasonal rhythms. Melatonin is not a sleep aid, but may be used to shift circadian rhythms.

Environmental Cues

The ebb and flow of circadian rhythms is not strictly biological; environmental cues also play a part.

- Bright light (especially sunlight)
- Sleep-wakefulness cycle
- Daily fluctuations of body temperature
- Sleep is best when body is at lowest temperature (97-97.5)

7.4.4 Disruptions in Circadian Rhythms: Shift Work and Jet Lag

Jet lag

When traveling, you reach your destination at a time when it is daylight there, but it would have been time to go to sleep at the place you started. This can produce memory deficits that may be permanent. Supplemental melatonin has been shown to be an effective treatment for relapses of psychiatric disorders induced by jet lag.

Zeitgebers are accelerated or decelerated. Research indicates that frequent flyers, such as this airline employee, are just as likely to suffer from jet lag when crossing several time zones as travelers who are on their first intercontinental journey.

Reducing Jet Lag

- Gradually shift sleep-wake cycle prior to travel.
- Administer post-flight treatments to promote the needed shift
- Phase advance following east-bound travel with intense light early in the morning
Shift work & Subjective night

When people work during the night and sleep during the day. Shift workers average 2 to 4 hours less sleep than non-shift workers of the same age.

Subjective night is the time during a 24-hour period when body temperature is lowest and when the biological clock is telling a person to go to sleep. During subjective night, energy and efficiency are at their lowest point, reaction time is slowest, productivity is diminished, and industrial accidents are significantly higher.

Zeitgebers unchanged, but sleep-wake cycle must be altered. Rotating work schedules forward from days to evenings to nights makes adjustment easier because people find it easier to go to bed later and wake up later than the reverse.

Modafinil: A wakefulness drug that will help people remain alert without the side effects of stimulants such as caffeine.

Reducing the Effect of Shift Changes

- Schedule phase delays, rather than phase advances
- Move from current schedule to one that starts later
- It is easier to stay up later and get up later than to retire and arise earlier
- Phase advances are harder, explaining why east-bound travel tends to be more problematic
- Shift workers who temporarily reside at their work places, such as workers on offshore oil rigs, appear to adjust more easily to the demands of night work than those who live at home
- Exposure to appropriately timed bright light or even light of medium intensity has been found to reset young adults’ biological clocks and improve their performance

Work schedules

- Moving work schedules forward from days to evenings to nights makes adjustment easier.
- Rotating shifts every three weeks lessens the effect on sleep

7.4.5 Variations in Sleep

Infants and young children have the longest sleep time and the highest of REM and slow wave sleep.

Ages 6-puberty are most consistent sleepers and wakers; sleep and awake same time daily.

Adolescents sleep patterns are influenced by their schedules; sleep longer when no schedule conflicts; poor sleep may contribute to poor school performance.

Larks and owls

Larks

- Awaken early every morning and leap out of bed with enthusiasm, eager to start the day
• Body temperature rises rapidly after they awaken and stays high until about 7:30 p.m.
• Turn in early and have the fewest sleep problems

Owls
• Fumble for the alarm clock and push the snooze button to get a few more precious minutes of sleep
• Body temperature of an owl gradually rises throughout the day, peaking in the afternoon and not dropping until later in the evening

Guthrie and others compared the performance of several hundred college students classified as larks or owls. They found that the larks made better grades in early morning classes, while the owls made higher grades in classes they took later in the day. A gene that runs the biological clock is responsible, in part, for the differences between larks and owls.

ACTIVITY 7.2

iii) Describe the biological and environmental factors that influence circadian rhythms.
iv) Explain how circadian rhythm disruptions influence physical and psychological functions.

7.5 SLEEP DISORDERS – PARASOMNIAS

Somnambulism (sleepwalking): Occurs during partial arousal from stage 4 sleep.

Sleep terror: Happens during partial arousal from stage 4 sleep usually begins with a piercing scream.

Nightmares: Frightening dreams that occur during REM sleep.

Somniloquy (Sleeptalking): Occurs during any sleep stage and is more frequent among children.

7.5.1 Major Sleep Disorders

Insomnia: A sleep disorder characterized by:
• Disorders of sleep initiation and maintenance
• Difficulty falling or staying asleep
• Waking too early
• Sleep that is light, restless, or of poor quality
• Symptoms can lead to distress and impairment in daytime functioning
Hypersomnia: Disorders of excessive sleep or sleepiness

Sleep apnea: Periods during sleep when breathing stops and the individual must awaken briefly in order to breathe caused by muscle spasms or atonia or failure of the CNS to stimulate breathing.

Most commonly seen in males, the overweight, and in the elderly, the major symptoms are excessive daytime sleepiness and extremely loud snoring, often accompanied by snorts, gasps, and choking noises.

Alcohol and sedatives aggravate the condition. It can lead to chronic high blood pressure, heart problems, and even death and also mild brain damage. The interrupted sleep experienced by individuals with this disorder affects cognitive as well as physiological functioning.

Narcolepsy: Also a form of hypersomnia characterized by excessive daytime sleepiness and repeated brief uncontrollable attacks of daytime REM sleep, usually lasting 10 – 20 minutes; an incurable sleep disorder.

Cataplexy: Loss of muscle tone while awake
Sleep paralysis: Paralyzed while falling asleep or upon waking
Hypnagogic hallucinations: Dreaming while awake; appears to be an abnormality in the mechanisms that triggers REM.

Dreaming and loss of muscle tone while awake suggest REM intruding into wakefulness. REM without atonia (able to act out dreams) possibly caused by damage to the nucleus magnocellularis or its output.

Hypothalamus and Sleep
During WWI, victims of encephalitis lethargica caused some to sleep continuously and others to sleep little
- Damage in posterior hypothalamus and adjacent midbrain > excessive sleep
- Damage in preoptic area and adjacent forebrain > wakefulness.

CONSCIOUSNESS

Consciousness can take many forms, while other mental processes occur simultaneously outside our awareness. Consciousness changes in cycles that correspond to our biological rhythms and the patterns of stimulation in our environment.

Everything of which we are aware at any given time
- Thoughts
- Feelings
- Sensations
- External stimuli
7.6.1 What Other Forms Can Consciousness Take?

An altered state of consciousness is a mental state other than ordinary waking consciousness, such as sleep, meditation, hypnosis, or a drug-induced state. It occurs when some aspect of normal consciousness is modified by mental, behavioral, or chemical means.

**Hypnosis:** Induced state of altered awareness, characterized by heightened suggestibility and deep relaxation

**Meditation:** Form of consciousness change induced by focusing on a repetitive behavior, assuming certain body positions and minimizing external stimulation

**Psychoactive drug states:** Chemicals that affect mental processes and behavior by their effects on the nervous system

### Meditation

A group of techniques that involve focusing attention on an object, a word, one’s breathing, or one’s body movements. It is an effort to block out all distractions to enhance well-being and achieve an altered state of consciousness.

Includes: Yoga, Zen, and transcendental meditation

- **Yoga:** A meditator typically assumes a cross-legged position known as the lotus and gazes at a visual stimulus
- **Zen:** The individual counts breaths or concentrates on the breathing process. Can be helpful with physical and psychological problems (Lower blood pressure; learn how to control emotions)

### Hypnosis

A procedure through which one person, the hypnotist, uses the power of suggestion to induce changes in a person’s thoughts, feelings, sensations, perceptions and/or behavior.

**Hypnotizability:** Degree to which an individual is responsive to hypnotic suggestions. 80-95% of people are hypnotizable to some degree; about 5% can reach deepest levels of feelings, sensations, perceptions and/or behavior.

**Misconceptions About Hypnosis**

- Hypnotized people are under the complete control of the hypnotists and will violate their moral values.
- People can demonstrate superhuman strength and perform amazing feats under hypnosis.
- Subjects are not stronger or more powerful under hypnosis.
- Memory is more accurate under hypnosis.

**Pseudomemories:** False memories constructed through guidance.
**Theories of Hypnosis**

**Sociocognitive:** Suggests the behavior of a hypnotized person is a function of that person’s expectations about how subjects behave under hypnosis.

**Neodissociation theory:** Suggests that hypnosis induces a split, or dissociation, between two aspects of the control of consciousness.

- The planning function
- The monitoring function

**Theory of Dissociated Control:** Maintains that hypnosis weakens the control of the executive function over other parts of consciousness.

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**Psychoactive Drugs**

Any substance that has powerful effects on the brain and alters consciousness, mood, perception and/or thought.

Psychoactive drugs are:
- Controlled substances/approved for medical use
- Illicit drugs/drugs that are illegal
- Over-the-counter drugs

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**How Drugs Affect The Brain**

All physical pleasure has a neurological basis brought about by increase of dopamine in limbic system known as the nucleus accumbens.

**Nucleus accumbens:** A surge of dopamine has a reward and motivational effects produced by psychoactive drugs. The effects of drugs cascades down involving the brain’s entire neurotransmitter system.

**Hallucinogens:** Alter perceptions of the external environment and inner awareness (also called psychedelics); mescaline, LSD, PCP and cannabis.

**Opiates:** Highly addictive; produce a sense of well-being and have strong pain-relieving properties; Heroin, Morphine, Heroin and Methadone.

- Mimic the effects of the brain’s own endorphins
- Chemicals in the brain with pain relieving properties
- Produce feelings of well-being
- Useful in pain management

**Depressants:** Slow down mental and physical activity by inhibiting transmission of nerve impulses in the central nervous system; Alcohol, Barbiturates, Benzodiazepines (Tranquilizers), Valium and Librium;
Act on GABA receptors to produce a calming, sedating effect. Useful in reducing a patient’s nervousness prior to undergoing a medical procedure.

**Stimulants:** Arouse the central nervous system, speeding up mental and physical responses; Caffeine; Nicotine; Amphetamines; Cocaine; MDMA (ecstasy); Mimics the effects of epinephrine The neurotransmitter that triggers the nervous system Benefits include suppression of hunger and digestion

Amphetamines affect the parts of the brain that control attention and concentration, as well as the nucleus accumbens. This helps explain why these stimulants are useful in the treatment of attention problems in school children.

**Substance Abuse**

A continued use of a substance after several episodes in which use of the substance has negatively affected an individual’s work, education, and social relationships.

People progress from substance “use” to “abuse” by
- The physical pleasure
- Genetically based differences in people’s responses to drugs
- Personality and social factors
- Stress related variables
- Social and cultural factors

**Drug Dependence (addiction)**

**Physical drug dependence:** A compulsive pattern of drug use in which the user develops a drug tolerance coupled with unpleasant withdrawal symptoms when the drug is discontinued.

**Drug Tolerance:** A condition in which the user becomes progressively less affected by the drug must take increasingly larger doses to maintain the same effect or high.

**Withdrawal Symptoms:** The physical and psychological symptoms that occur when a regularly used drug is discontinued; usually the exact opposite of the effects produced by the drugs. Symptoms terminate when drug is taken again.

**Psychological Drug Dependence:** A craving or irresistible urge for the drug’s pleasurable effects; more difficult to combat than physical dependence. Drugs that may not be physically addictive may be due to psychological dependence. Learning processes (classical conditioning) are important elements in development and maintenance of psychological dependence.

**7.6.2 Culture and Altered States of Consciousness**

Every culture around the world have found ways to induce altered states of consciousness. They consist of trance rituals, spiritual possession, religious rites, and tribal ceremonies. These states are induced by flooding the senses with repetitive chanting, whirling in circles and/or burning strong, pungent incense.
1. Awareness of one's own perceptions, thoughts, feelings, sensations and external environment is _______.

2. Changes in awareness produced by meditation, hypnosis, and drugs are generally referred to as _______.

3. John has noticed that every night he awakens to go to the restroom at about 4:00 AM. This is an example of a(n) _______.

4. This structure in the brain regulates the biological clock in humans.

5. The most significant environmental cue that plays a role in circadian rhythms is _______.

6. When we are exposed to low levels of light the _______ begins to secrete the hormone melatonin, which acts to induce sleep.

7. If you managed a manufacturing plant that ran three rotating shifts, what could you do to help your employees remain in a more normal biological rhythm?

8. The _______ holds that being awake wears and tears on the body and brain, and sleep serves the function of restoring body and mind.

9. This theory is based on the premise that sleep evolved to keep humans out of harm's way.

10. Jason is in a quiet period of sleep where his heart rate and respiration are slow, and his brain activity is at its lowest point. Sleep researchers would say Jason is in _______.
11. How many stages are in REM sleep?

12. Which type of brain waves dominate slow-wave sleep?

13. Darla did not get any sleep during the previous night as she was studying for her mid-term exams. Tonight when she falls asleep she will likely experience:

14. Who has the longest average sleep time?

15. Research shows that sleep deprivation:

16. In lucid dreams, people ________.

17. ________ believed that dreams function to satisfy unconscious sexual and aggressive wishes.

18. ________ are sleep disturbances in which behaviors and physiological states that normally occur only in the waking state take place during sleep.

19. These generally begin with a piercing scream.

20. Excessive daytime sleepiness and sudden, uncontrollable attacks of REM sleep are symptoms of:
Suggested Text and References

1.2 Required Reading:

1.3 Suggested Readings


1.4 Suggested Web Sites
The Sleep Well
http://www.stanford.edu/~dement/alphaindex.html

SleepNet
http://www.sleepnet.com/

Basics of Sleep Behavior
http://bisleep.medsch.ucla.edu/sleepsyllabus/

National Centers on Sleep Disorders Research
http://www.nhlbi.nih.gov.about.ncsdr/
Self-check

1. consciousness
2. altered states of consciousness
3. circadian rhythm
4. suprachiasmatic nucleus
5. bright light.
6. pineal gland
7. Install appropriate bright lights and use a three-week rotational schedule.
8. Restorative theory
9. circadian theory of sleep
10. NREM sleep.
11. one.
12. delta
13. REM rebound.
14. infants
15. has a negative impact on mood, alertness and performance.
16. attempt to influence the content of their own dreams.
17. Freud
18. Parasomnias.
19. sleep terrors
20. narcolepsy.