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Sleep Disorders

Although we have some general understanding of the biochemical, neurophysiological, and neuroendocrine activities during sleep, we still do not entirely understand the function of sleep. Certainly, sleep appears to be both restorative and homeostatic, helping us to conserve energy and maintain our body temperature. Sleep is also important in the consolidation of learning and memory and for healthy neurocognitive functioning (Brawn, Fenn, Nusbaum, & Margoliash, 2008). It has been suggested that the programming of species-specific behaviors occurs during sleep, such that animals and humans rehearse instinctual behaviors during sleep (Tauber & Glovinsky, 1987). Regardless of its function, problems with sleep are ubiquitous and sometimes a cause for great concern. Although individuals with diagnosable sleep problems generally have higher rates of mood and anxiety disorders than the general population, the vast majority do not suffer major psychiatric impairments.

CLINICAL PRESENTATION

Most parents struggle to help their infants, children, and adolescents establish habits of good sleep hygiene. Parents must teach infants to self-soothe and put themselves back to sleep in the middle of the night, for no child truly sleeps through the night. Infants awaken every few hours, as do children and adults, simply to roll over and fall back to sleep. If we do not teach our infants to fall asleep on their own, they will never be able to soothe themselves back to sleep during these normal nighttime awakenings.

Some parents prefer a family bed, where all members co-sleep in

the same bed or sleep separately but share the same room. Unlike our psychoanalytic forefathers, psychiatrists today have no reason to suspect that sleeping in the same bed or room is damaging in any way to our children's psyche. Yet children must still learn the skill of falling asleep on their own even in a family bed. Without this training, our children's sleep will be disrupted by their awakenings, during which time they will search out a parent to soothe them back down, which leads to even more awakenings and fracturing of a normal night's sleep. The only situation in which sleeping with an infant or child is potentially dangerous is when the parent has been drinking alcohol or taking medications or drugs that can impair his or her ability to awaken easily. In these situations, the risk of sudden infant death syndrome (SIDS) is increased, as the parent may roll over on top of the infant and suffocate the child without awakening.

Children and adolescents have many additional issues with sleep. Children may wet the bed or experience nightmares, narcolepsy, night terrors, or insomnia; others may sleepwalk, talk in their sleep, grind their teeth, or suffer breathing difficulties during sleep; still others may simply refuse to go to bed. Adolescents may experience these difficulties as well, in addition to a delayed sleep phase, such that their sleep cycle becomes shifted to later in the evening. Sleep-phase disorders can lead to severe difficulties with awakening on time for school or other activities.

Infants, children, and adolescents traverse most sleep problems without seeking professional consultation. Still, most parents will benefit from learning about sleep and proper sleep hygiene, which will allow them to teach their children good sleep habits, and that in turn will promote a more refreshing night's sleep and better daytime energy and concentration (Weiss, Wasdell, Bomben, Rea, & Freeman, 2006).

Sleep Problems Associated With Psychiatric Conditions

Sleep difficulties are common in a number of psychiatric disorders and a core *DSM-5* symptom among other psychiatric conditions. Disrupted sleep has long been recognized as a feature of children diagnosed with attention-deficit/hyperactivity disorder (ADHD), for example. The *Diagnostic and Statistical Manual of Mental Disorders*, third edition (*DSM-III*), in fact, considered excessive movements during sleep to be a criterion for hyperactivity in children (American Psychiatric Association, 1980). Children with ADHD usually show greater variation in sleep onset time, wake time, and sleep duration; significantly more bedtime struggles with parents than other children; an increase in the frequency of habitual snoring to three times that among the general population; and a greater

frequency of periodic leg movement disorder (PLMD) and sleep-disordered breathing (SDB) (Sung, Hiscock, Sciberras, & Efron, 2008).

Children, adolescents, and adults diagnosed with autism spectrum disorders also commonly experience sleep difficulties. The clinical presentation of these children may include difficulties falling asleep, frequent awakenings with difficulty returning to sleep, early-morning awakening, irregular sleep–wake patterns, a shortened duration of sleep, and dyssomnias and parasomnias (Johnson & Malow, 2008).

The clinical presentation of children with mood disorders may include bedtime resistance or anxiety, early and middle insomnia, a desire to co-sleep with parents because of fears or bad moods, enuresis, nightmares, sleepwalking, early-morning awakening, and excessive daytime sleepiness. Over 50% of depressed adolescents report difficulties falling and staying asleep with extended evening awakenings, excessive daytime sleepiness, and unrefreshing sleep, while a much smaller percentage report hypersomnia (Liu et al., 2007). Adolescents who report sleep problems are also much more likely to report symptoms of depression, anxiety, poor self-esteem, lethargy, irritability, and emotional lability even in the absence of a proper mood disorder (Ivanenko, Crabtree, & Gozal, 2005). Adolescents who report sleep problems are also much more likely to consume caffeine, nicotine, alcohol, and drugs, which themselves cause difficulties with sleep (Roane & Taylor, 2008). Consequently, sleep problems should be viewed as a potential early marker for adolescents at risk of developing some sort of psychopathology.

The clinical presentation of anxiety in children includes nighttime fears that commonly take the form of animals and age-appropriate fictitious characters, such as witches and monsters. Children may also fear being kidnapped or being teased by peers. Anxiety also appears to predispose children to parasomnias and nightmares (Muris, Merckelbach, Gadet, & Moulaert, 2000).

ETIOLOGY

Electroencephalography (EEG) provides a reliable and reproducible measure of brain waves during sleep and allows us to define various sleep stages. While awake and alert, the brain is predominantly generating beta waves. As seen in Figure 18.1, beta waves are of low amplitude and are the fastest of the four types of brain waves, running at a frequency of 15 to 40 cycles per second (Hz). The presence of beta waves indicates an active and engaged mind. Someone in conversation would be producing lots of beta waves; during an argument, an individual would be in high beta. When

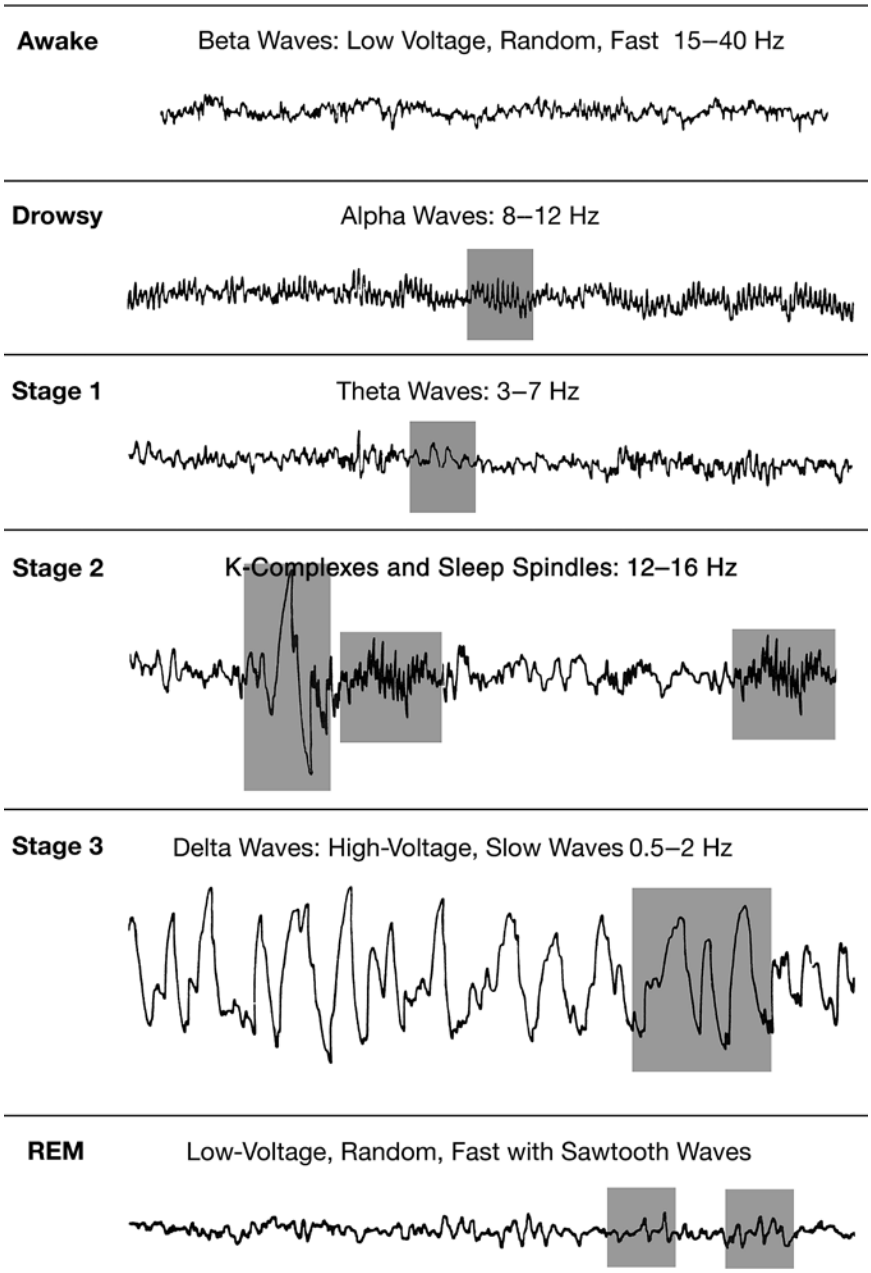

Figure 18.1 EEG sleep patterns. Figure 18.1 illustrates the characteristic brain waves of each sleep stage. Source: Kaplan, Sadock, and Greb (1994, p. 700).

the eyes are shut and there is a subsequent lack of visual processing, the EEG shows a slightly higher voltage and slower (8- to 12-Hz) brain wave pattern, characterized by the presence of alpha waves. Alpha waves appear regardless of drowsiness and represent a relative lack of focus and decreased visual processing. Alpha waves emanate from the occipital lobe of the brain, where the visual centers are housed. Alpha waves are less prevalent in the blind, particularly those who have been blind since birth. Alpha waves occur during the waking state and will appear in every sleep stage at various times, particularly during dream sleep. Someone resting or relaxing will experience an increase in alpha waves.

Sleep begins in Stage 1 and by definition begins at the moment alpha waves disappear from the EEG. Stage 1 sleep is characterized by brain waves of still greater amplitude and lower frequency, around 3 to 7 Hz. Theta waves are the predominant EEG brain wave pattern evident during this stage of sleep. Theta waves appear during daydreaming, while drowsy, or even when engaged in a repetitive task, such as freeway driving. As opposed to city driving, where one is always concentrating on the traffic and beta waves are largely in evidence, freeway driving often brings on theta waves because the task requires a lower level of concentration and is sometimes performed while in a trancelike state. At any time that one is involved in an automatic task from which one can mentally disengage while still performing the task (e.g., brushing teeth, taking a shower, jogging, swimming laps, meditation, yoga), the predominant theta waves are hypothesized to place one in a state of "flow," in which many individuals report the generation of good ideas and mental well-being (Csikszentmihalyi, 1991; Wachsmuth & Dolce, 1980). Theta waves emerge from the cortex and hippocampus. Jerking movements or sudden twitches, known as positive myoclonus, along with hallucinations upon drifting off to sleep, known as hypnagogic hallucinations, are common during Stage 1, as is some degree of muscle tone loss and decreased conscious awareness of the external environment. Stage 1 sleep occupies about 2% to 5% of total sleep time in children.

Stage 2 sleep is notable for high-amplitude waves at 12 to 16 Hz, along with sleep spindles, which are characteristic jagged runs on the EEG. In addition, larger spikes, known as K-complexes, are present. Sleep spindles originate in the thalamus and are thought to represent efforts by the brain to inhibit processing in order to keep the sleeper tranquil. K-complexes originate widely in the cortex and are brief, high-voltage peaks, usually followed by bursts of sleep spindles, which may occur in response to both internal (e.g., digestive) and external (e.g., auditory or tactile) stimuli during sleep. K-complexes are thought to suppress cortical arousal and aid in sleep-based memory consolidation. Stage 2 sleep

is notable for reduced muscle tone and decelerations in respiration and heart rate. Children can move about freely and reposition themselves during Stage 2, which occupies about 50% of total sleep time.

Stages 3 and 4 are characterized by high-amplitude slow delta waves occurring at 0.5 to 2 Hz. Previously distinguished by the predominance of delta waves (e.g., in Stage 3 delta waves accounted for less than 50% of the total wave patterns and in Stage 4 more than 50%), the American Academy of Sleep Medicine has now eliminated this distinction from their staging system. Currently, all delta wave, slow-wave, or deep sleep is categorized as Stage 3, and Stage 4 no longer exists (Schulz, 2008). Delta waves emanate from the cortex and thalamus aid in declarative memory formation consolidation and hormone release, Parasomnias, such as night terrors, sleepwalking, sleep talking, and bruxism, commonly occur during deep sleep, which accounts for about 20% of total sleep time.

Finally, REM sleep, commonly thought of as dream sleep, is the final sleep stage. So named because of the frequent flickering of the eyelids observed as the eyes move underneath, REM sleep is characterized by low-voltage random waves emanating from throughout the cortex, causing a periodic sawtooth pattern. More than at any other sleep stage, the brain waves during REM sleep look a great deal like those during the awake state. REM constitutes the greatest proportion of sleep in infants (approximately 55%), declining to about 25% by 5 years of age. The high proportion of REM during the first year of life is thought to be important for brain stimulation and rapid neural growth. Both REM and Stage 3 are homeostatic, meaning that when deprived of sleep, the body will preferentially "rebound" into these stages once sleep is allowed. This observation suggests that both deep sleep and REM are essential. Although certain brain waves predominate at different stages of sleep, alpha, beta, theta, and delta are all present, if only in trace amounts, throughout the day and in each sleep stage.

In order to understand sleep pathology, one must first understand some basic terms utilized in the study of sleep:

- *Sleep latency* is the period of time required to fall asleep, typically taken as the amount of time it takes to enter Stage 1.
- *REM latency* is defined as the amount of time between the onset of sleep and the first REM period.
- *REM density* is defined as the number of eye movement bursts or frequency of eye movements per minute of REM sleep.
- *REM rebound* describes the body's preference for REM when in a sleep-deprived state and the fact that the body will more rapidly "rebound" into REM when the individual is underslept.

- *Sleep-onset REM* occurs when one lapses immediately into REM upon falling asleep, bypassing Stages 1, 2, and 3, as occurs with narcolepsy.

For purposes of understanding sleep physiology and pathology, it is useful to think of sleep as being subdivided into REM and non-REM (Stages 1 through 3). During non-REM, there is generally reduced physiological activity, as evidenced by slowing of the heart rate and respiration, decreased metabolic function, and a decrease in the activation of the autonomic nervous system, yet the body maintains a steady internal temperature. During non-REM sleep, one can move about freely and may pull up the blankets if too cold or kick off the sheets if too warm. Non-REM is also notable for episodic involuntary and sometimes jerky movements. Finally, during non-REM there is a slowing of blood flow, few penile erections, and little vaginal lubrication. REM sleep physiological changes, by contrast, are the opposite of those in non-REM sleep.

REM sleep is notable for increased physiological activity and autonomic nervous system activation. Altered thermoregulation, such that the body does not maintain a steady internal body temperature, and partial or full penile erections and significant vaginal lubrication are also characteristic. Skeletal muscle paralysis and numerous REMs are also evident. It is theorized that skeletal muscle paralysis is necessary during REM sleep because we would otherwise stand up and act out our dreams, which tend to occur in greatest density during REM.

During REM sleep, cells in the preoptic/anterior hypothalamus, which are responsible for maintaining a steady body temperature, cease firing, causing us to experience poikilothermia or to respond like cold-blooded animals. Since our thermoregulatory cells stop functioning during REM, our body temperatures tend to approach the temperature of the ambient environment. Interestingly, when the ambient temperature is at an extreme of hot or cold, REM sleep is lost, as if the body is refusing to let such an uncomfortable temperature be imposed upon itself. Likewise, animals kept in thermoneutral zones during sleep, or temperature ranges of greatest comfort for their species, show a maximal amount of REM (Alam, McGinty, & Szymusiak, 1995; Buguet, 2007).

The cyclical nature of sleep is reliable. REM periods occur about every 90 to 120 minutes. The first REM period is the shortest. Most deep sleep, Stage 3, occurs early in the evening, while most REM sleep occurs later. The normal sleep cycle for children is portrayed in Figure 18.2. In contrast to adult sleep, the density of deep sleep early in the evening is somewhat greater during childhood. In the elderly population, there is little Stage 3 sleep, particularly after age 70. Sleep becomes more frag-

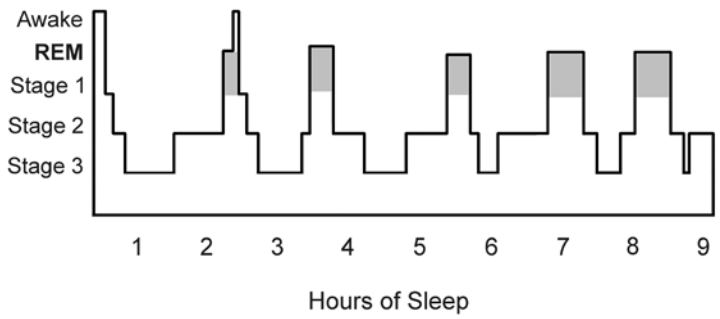

Figure 18.2 Normal sleep cycle in children. Figure 15.2 illustrates the relative time spent in each sleep stage throughout a typical evening.

mented by this age, and there are numerous awakenings throughout the evening, particularly toward the morning. It is this relative lack of deep sleep that often causes the elderly to feel sleepy throughout the day and accounts for their frequent naps.

There is no clear single center that regulates sleep, but we do recognize numerous brain structures, neurochemicals, and hormones that are involved. The neurochemicals serotonin, norepinephrine, dopamine, histamine, glutamate, aspartate, acetylcholine, and gamma aminobutyric acid (GABA) all play a role. The suprachiasmatic nucleus, located within the hypothalamus, is responsible for controlling endogenous circadian rhythms. The suprachiasmatic nucleus contains several cell types and releases several different peptide hormones, including vasopressin (antidiuretic hormone) and vasoactive intestinal peptide. Numerous other hormones are also involved in sleep, such as growth hormone, cortisol, thyroid hormone, leptin, and ghrelin.

Orexin, a pair of excitatory neuropeptide hormones, so named because of their orexigenic (appetite-stimulating) activity, are synthesized in the hypothalamus and involved in narcolepsy. Dogs lacking an orexin receptor have narcolepsy, while people and other animals lacking the orexin neuropeptide itself also have narcolepsy. Another hormone, melatonin, is synthesized by the pineal gland and is released at night and inhibited by ambient light. While exogenous administration increases total sleep time and decreases sleep latency, the exact role of melatonin in sleep has yet to be elucidated. Growth hormone is released during Stage 3 sleep in children. Consequently, children who do not obtain adequate deep sleep are at risk of growth retardation.

The onset of sleep is associated with a dramatic reorganization of thermoregulatory control. Core body temperature falls at sleep onset aided by a variety of heat loss mechanisms, such as sweating and vasodi-

lation at the periphery; as the core body temperature drops, the peripheral body temperature heats. The fall in core body temperature and slowed metabolism presumably contribute to energy conservation, which may be one of the most important roles of sleep. In general, we sleep best at night when our core body temperature is low and our melatonin levels are elevated. In fact, mounting evidence suggests that sleeping medications and melatonin tend to decrease our core body temperature and that caffeine tends to increase it. Anything that heats our core in the evening generally has the effect of fracturing or delaying our sleep, such as a long hot shower or bath before bed. Our reaction time and alertness are at their peak when our core body temperature is at its normal level, approximately 98.6 degrees Fahrenheit. The core body temperature hits its nadir about four hours before our usual wake time, at which point our alertness and reaction time are also at their lowest.

Given the timing of our physiological processes to sleep and wake periods, it is clear that humans have evolved in line with the day and night cycles of our universe. For each hour we are awake, we incur a sleep debt of about 30 minutes. Sleep debt builds throughout the day, eventually becoming so overwhelming that we sleep. Borbély (1982) proposed a "two-process model" of sleep, as shown in Figure 18.3. Process S repre-

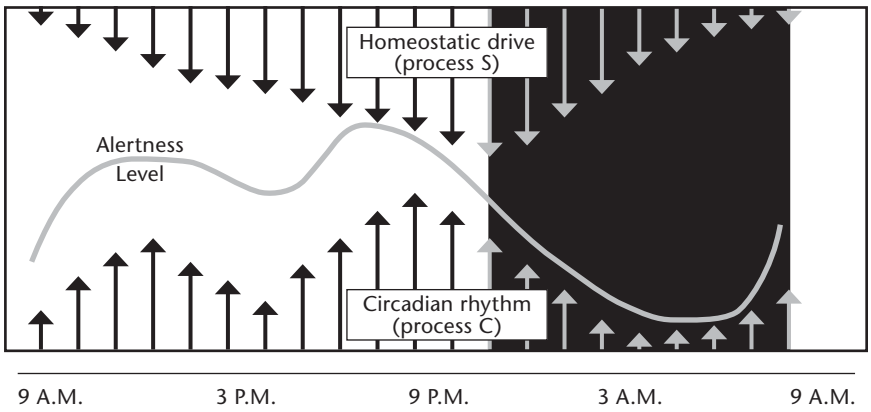

Figure 18.3 The two-process model of sleep. The Two Process Model explains the variation in our alertness over a 24-hour period. Process C, or the circadian drive, rises in the morning, decreases midday (corresponding to an increase in melatonin and timed to a midday siesta), and then increases throughout the late day and early evening in opposition to the increasing homeostatic sleep drive, or Process S. After typically about 16 hours in adults, the sleep drive, which has been building all day, becomes too much for our bodies to oppose, and we fall asleep (represented by the darkened area of the graph). Our alertness varies throughout the day in response to the relative drives of Process C and Process S.

sents the homeostatic, internal sleep drive which builds throughout the day, placing increasing sleep pressure on the individual. Process C represents the circadian rhythm or our wake-promoting drive, which varies in strength throughout the day. In the midafternoon, coincident with a rise in melatonin, Process C drops; later in the day, Process C reaches its peak in order to help us stay awake just as our sleep debt is reaching its greatest point. The interaction between Process C and Process S represents a theoretical but probable model that dictates our alertness throughout the day.

Perhaps the purpose of sleep is to dream. Until just recently, we believed that dreams occurred only during REM sleep. This observation was founded upon the fact that when individuals were awoken during REM, they could rapidly and easily recount their dreams, whereas when awoken in other stages of sleep, dreams were not easily recalled. In recent years we have come to understand that individuals do, in fact, dream during non-REM sleep, but these dreams are often brief, fragmented, and not as vivid and well remembered.

Neurocognitive Effects of Sleep Disruption

We have limited data on the neurocognitive effects of sleep disruption on children's attention and memory. Most of our information is based on studies of the daytime performance of children with sleep-disordered breathing (SDB). The most common cause of SDB is sleep apnea, which can affect both children and adults. When an individual is apneic, the brain does not receive sufficient oxygen, and sleep is interrupted. These individuals generally do not reach deep sleep or REM and are constantly awoken throughout the night as they gasp for air (Gozal, O'Brien, & Row, 2004). Sleep restriction in experimental settings causes daytime inattention and changes in cortical EEG responses even after only one hour of restriction the night before (Randazzo, Muehlbach, Schweitzer, & Walsh, 1998). Data are inconsistent regarding the effects of sleep disruption on memory performance, yet children suffering from obstructive sleep apnea (OSA), periodic limb movement disorder (PLMD), and restless legs syndrome (RLS) with resulting sleep fragmentation have been shown to suffer academic deficits, learning problems, and symptoms that mirror attention-deficit/hyperactivity disorder (ADHD). In the case of OSA at least, symptoms are generally reversible after treatment (Chervin & Archbold, 2001; Chervin et al., 2002).

Neuropsychological testing has been useful in demonstrating the acute effects of sleep restriction on children and adolescents. Sleep restriction and total sleep deprivation reduce computational speed, impair ver-

bal fluency, and decrease creativity and abstract problem-solving ability (Engleman & Joffe, 1999; Fallone, Acebo, Arnedt, Seifer, & Carskadon, 2001). Severe sleep fragmentation, as seen in OSA, may even result in reduced IQ scores. Sleep disruption can also have clear effects on academic achievement (Gozal, 1998). In fact, children with OSA suffer lower academic achievement even when age, race, gender, socioeconomic status, and school attended are controlled for. Furthermore, just one additional hour of sleep in children aged 8 to 12 years over one week results in parent and child reports of improved emotional functioning and objective improvements in memory, attention, and math fluency (Vriend et al., 2013). Likewise, in children 7 to 11 years old, one additional hour in bed, averaging 27 minutes of additional sleep, leads to improvements in teachers' blinded ratings of emotional lability and impulsivity (Gruber, Cassoff, Frenette, Wiebe, & Carrier, 2012).

The treatment of OSA results in significant improvement in school performance. Even children who snore loudly and consistently in their early years are at a greater risk for academic delays in later years, suggesting some residual effects on learning that continue even after resolution of symptoms (Blunden, Lushington, Kennedy, Martin, & Dawson, 2000). Animal models show increased locomotor activity and neuron cell loss in the hippocampus and prefrontal cortex in rats exposed to intermittent hypoxia, along with decreases in special task acquisition and retention compared to controls (O'Brien & Gozal, 2004).

EPIDEMIOLOGY

Approximately 25% of youth will suffer a sleep problem at some point during childhood (Owens & Witmans, 2004). Complaints range from bedtime resistance and anxiety to primary sleep disorders, such as OSA and narcolepsy. Research is remarkably consistent, with parents reporting about 50% of preschool children (S. Kerr & Jowett, 1994), 30% of school-age children (M. A. Stein, Mendelson, Obermeyer, Amronin, & Benca, 2001), and 40% of adolescents as having sleep difficulties (Smedje, Broman, & Hetta, 2001). Self-reports among adolescents reveal that up to one third complain of frequent or extended nighttime awakenings, excessive daytime sleepiness, unrefreshing sleep, trouble falling asleep, or a subjective need for more sleep (Patten, Choi, Gillin, & Pierce, 2000; Saarenpää-Heikkilä, Laippala, & Koivikko, 2001).

Perhaps the most frightening sleep disorder, SIDS, has seen a worldwide decline in the past decade. The incidence is estimated at about 0.77 per 1,000 live births in Great Britain. The incidence in the United States

has dropped more than 50%, from 1.53 per 1,000 live births in 1980 to 0.56 per 1,000 live births in 2001 (Arias, MacDorman, Strobino, & Guyer, 2002; Leach et al., 1999). Still, SIDS accounted for 8% of all infant deaths in the United States in 2002 and ranks as the third leading cause of infant death in the United States (Hoyert, Mathews, Menacker, Strobino, & Guyer, 2006). In the United States, the SIDS rate for African and Native American infants remains at more than twice that of Caucasian infants, reflecting a long-standing racial disparity.

Narcolepsy occurs at a rate of about 1.37 per 100,000 and has a prevalence of 56 per 100,000 in the United States (Kotagal, 2008). Narcolepsy most commonly sets on during the second decade of life but is not uncommonly diagnosed in the third and fourth decades. Cataplexy, or the sudden loss of muscle tone, which commonly occurs secondary to an emotional trigger such as anger or laughter, affects 50% to 70% of those with narcolepsy.

The prevalence of pediatric insomnia is estimated at between 1% and 6% in the general pediatric population but considerably higher among those children with neurodevelopmental delays and chronic medical and psychiatric conditions (Ivanenko et al., 2004; Manni et al., 1997; M. A. Stein et al., 2001). A study of children aged 5 to 16 years found that 50% of those presenting to a pediatric sleep center for insomnia had a preexisting psychiatric diagnosis, while the remaining 50% had elevated psychiatric impairment scores on psychometric measures and diagnostic interview. Perhaps the majority of children with pediatric insomnia, then, may have at least psychiatric symptoms, if not an actual disorder (Ivanenko, Barnes, Crabtree, & Gozal, 2005).

The prevalence of snoring among children is somewhere between 7% and 12%, while OSA is much less frequent, with a prevalence of 1% to 2% (Ersu et al., 2004; Gozal, 1998). The frequency of upper airway resistance syndrome, a relatively newer category of SDB, has been as yet difficult to ascertain.

Enuresis occurs in approximately 30% of 4-year-olds, 10% of 6-year-olds, 5% of 10-year-olds, 3% of 12-year-olds, and about 1% of those 15 years of age and over (Byrd, Weitzman, Lanphear, & Auinger, 1996; Essen & Peckham, 1976; Feehan, McGee, Stanton, & Silva, 1990; Fergusson & Horwood, 1994; Hellström, Hanson, Hansson, Hjalmas, & Jodal, 1990; Kalo & Bella, 1986; Klackenberg, 1981; Rahim & Cederblad, 1986). Although not satisfying *DSM-5* criteria for a diagnosis, between 10% and 20% of 5-year-olds continue to have at least one episode of nocturnal enuresis per month (N. J. Klein, 2001).

Non-REM parasomnias are common among children and adolescents. As an example, *sleep terrors* affect somewhere between 3% and

7% of children and 1% to 3% of adults (American Psychiatric Association, 2000). Sleepwalking is a much more common occurrence, with a prevalence of somewhere between 6% and 17% in children and a lifetime incidence of as high as 40% in the general population. The prevalence in adults is about 1% to 2% (Mahowald & Rosen, 1990). Although not a formal *DSM-5* diagnosis, *confusional arousals* are described in the International Classification of Sleep Disorders (American Sleep Disorders Association, 2007). Confusional arousals are essentially sleepwalking episodes during which an individual becomes confused and disruptive. The epidemiology of such events is unclear. In one Stockholm study, a 4% incidence was noted (Klackenberg, 1981).

Sleep Problems Associated With Psychiatric Conditions

All varieties of sleep disorders are about five times more common among children with ADHD than healthy controls, controls with other psychiatric disorders, and healthy siblings (Corkum, Tannock, & Moldofsky, 1998). It is estimated that up to 25% of children with severe sleep problems in infancy will later meet criteria for a diagnosis of ADHD (Thunström, 2002). Up to 83% of children with a diagnosis of frank autistic disorder are reported to suffer sleep difficulties, as are up to 86% of children with autism spectrum disorders (Patzold, Richdale, & Tonge, 1998; Richdale & Prior, 1995; Wiggs & Stores, 1996). Younger children and those with more significant cognitive delay or disability tend to demonstrate increased problems. Sleep problems are often longstanding. A study of adults with Asperger's syndrome, for example, demonstrated that 90% continue to complain of frequent insomnia (Tani et al., 2003).

Mood disorders too are commonly comorbid with sleep problems. Up to two thirds of children with a diagnosis of major depressive disorder have early and middle insomnia, and half of these children also report late insomnia or early-morning awakening (Puig-Antich et al., 1982). Nearly 90% of depressed adolescents report sleep disturbances, usually insomnia, with up to 25% of these teens reporting hypersomnia (Goetz et al., 1987). About 10% experience continued insomnia even after the depression is lifted (Goetz et al., 1983). One study of bipolar children found that 40% had a dramatically reduced need for sleep versus controls and those with ADHD (B. Geller, Zimerman, Williams, Delbello, Bolhofner, et al., 2002).

Anxiety and sleep are intimately tied in childhood. Sleep problems by age 4 are correlated with later-onset depression and anxiety by age 15

(Ivanenko et al., 2004). Nighttime fears are common and are reported by up to 75% of typical children (Muris et al., 2000). Sleep problems generally follow for those children with diagnosed anxiety disorders. Occasional nightmares occur in 80% of children; 15% report frequent nightmares (e.g., more than one a month); and up to 70% of children report that the content of their nightmares is influenced by frightening material viewed on television or at the movies (Hawkins & Williams, 1992; Muris et al., 2000). This statistic should not go unheeded by clinicians and parents. It is vital to acknowledge that the media has a major impact on children's thoughts and subsequent behavior and that parents must carefully monitor their children's media exposure, limiting that which frightens them or is not age appropriate.

CLINICAL COURSE

Most sleep disorders in children and adolescents are developmental and dissipate with time as the children outgrow them. Only a fraction of affected children, as already noted, continue to sleepwalk, wet the bed, or experience sleep terrors as adults, and the same is true with nightmares. SDB in children is most often due to enlarged tonsils and will generally be less troublesome as children age and their tonsils naturally shrink. Alternatively, tonsillectomy and adenoidectomy are almost always effective in treating the problem immediately. By contrast, narcolepsy is generally a lifelong condition with a stable course over time.

Primary insomnia is typically of sudden onset with continuation due to negative conditioning and the development of maladaptive sleep patterns. Individuals who have a series of nights or weeks where they have difficulty falling or staying asleep become rapidly conditioned into fearing that they will have difficulty falling or staying asleep; they then often develop a series of maladaptive behaviors, such as watching television in bed, sleeping on the couch, reading in bed, or drinking alcohol before sleep, all of which ultimately interfere further with their ability to maintain a good night's sleep.

DIAGNOSIS

Sleep is best studied by observation in a sleep lab, where the patient stays overnight. The gold standard of sleep studies is the polysomnogram (PSG). PSG is simply a term for describing the conglomeration of tests employed to study an individual during sleep. These measures usually

include videotaped observation, EEG, electromyography (which monitors muscle movements), electrooculography (which monitors eye movements), vital signs, and any other physiological parameters that may be relevant, such as electrocardiography to follow heart rate and rhythm.

Newer methods for studying sleep allow investigators to observe patients not simply in a sleep lab, but also in their home. The most common ambulatory technique involves actigraphy. This method was developed in the early 1970s and has come into increasing use in both research and clinical practice. Actigraphy allows for the study of sleep–wake patterns and circadian rhythms via the assessment of body movements. The device is worn on the wrist like a watch and can easily be adapted for home use. It is reliable and valid for the study of sleep in normal healthy populations but less reliable for detecting disturbed sleep.

A number of survey instruments, such as sleep diaries and questionnaires, also exist for detecting problematic sleep in children and adolescents. Self-report measures, such as the Sleep Disturbance Scale for Children, the Child Sleep Questionnaire, and the Child and Family Sleep History Questionnaire, along with parent report forms, are frequently helpful (Blader, Koplewicz, Abikoff, & Foley, 1997; Corkum, Moldofsky, Hogg-Johnson, Humphries, & Tannock, 1999).

Sudden Infant Death Syndrome

The most widely accepted definitions of SIDS require that all other possible causes of death be ruled out by death scene investigation, review of the clinical history, and autopsy prior to accepting SIDS as the diagnosis (Krous et al., 2004). Intentional or nonintentional injury and suffocation must also be considered.

DSM-5 Sleep Disorders

DSM-5 defines 11 general categories of sleep disturbances in the chapter on sleep–wake disorders. These include insomnia, hyperinsomnolence, narcolepsy, breathing-related sleep disorders, circadian rhythm sleep–wake disorders, parasomnias, nightmare disorder, REM sleep behavior disorder, restless legs syndrome, substance/medication-induced sleep disorder, and a generic series of "other" and "unspecified" forms. As with all *DSM-5* diagnoses, in order to be considered a "disorder," significant functional impairment must be present.

Insomnia

Insomnia among adults most commonly occurs in the early and midevening hours. Affected individuals have difficulty falling and staying asleep. In the vast majority of individuals with a diagnosis of insomnia, PSG studies are negative. Although many of these individuals display subclinical symptoms of psychiatric illness, most do not have another primary psychiatric diagnosis but are at greater risk than the general population (American Psychiatric Association, 2013).

Although insomnia has long been recognized among adults, no clear definition for pediatric insomnia existed until 2005. According to the International Classification of Sleep Disorders, pediatric insomnia is now defined as "frequent problems with sleep initiation, duration, consolidation, and/or quality that occurs despite adequate opportunity for sleep, resulting in daytime functional impairment for the child and/or family" (American Sleep Disorders Association, 2007, p. 26).

Behavioral insomnia is another diagnostic category recently introduced to describe the sleep difficulties resulting from inadequate parental limit-setting or sleep associations, such as rocking a child to bed at night, allowing a child to fall asleep in the parent's bed, or allowing children to watch television to fall asleep. Behavioral insomnia is characterized by the inability of the child to fall asleep in the absence of these conditions at both bedtime and following nocturnal awakenings.

Narcolepsy

Narcolepsy is diagnosed by nocturnal PSG, sleep history, and the multiple sleep latency test, which measures how long it takes the patient to fall asleep in a sleep lab during repeated nap opportunities. Symptoms of narcolepsy may set on all at once or gradually over a series of years.

Breathing-Related Sleep Disorders

Many children and adolescents snore. As long as there are no changes in sleep architecture, alveolar ventilation, or blood oxygenation and the child is not awakening frequently and experiencing difficulties throughout the day, there is generally no major concern. Still, however, snoring is not considered "normal." OSA is the most impairing of the sleep breathing difficulties faced by children and is characterized by frequent awak-

enings, blood oxygen desaturations, and poor sleep quality, resulting in excessive daytime sleepiness and many of the neurocognitive impairments previously noted. Upper airway resistance syndrome, which causes frequent awakenings, does not result in blood oxygen desaturations and is therefore less impairing.

Parents whose child suffers from sleep-disordered breathing (SDB) will commonly complain of hearing their child snore and also recount frequent awakenings, excessive daytime sleepiness, poor academic performance, irritability, poor executive functioning, and general inattention or cognitive impairment. Lab results for children who are severely affected by SDB will demonstrate a reduction in air flow and lowered hemoglobin oxygen saturation along with an increase in total hemoglobin. Sinus arrhythmias, premature ventricular contractions (PVCs), atrioventricular (AV) block, sinus arrest, and a preponderance of Stage 1 sleep signify severe impairment. Physical examination may show adenotonsillar enlargement, pectus excavatum, obesity, hypertension, and cor pulmonale or right heart enlargement.

Circadian Rhythm Sleep–Wake Disorders

Circadian rhythm sleep-wake disorders is a broad category for a variety of difficulties in which regular sleep disruption is due to a misalignment of the circadian rhythm and sleep–wake schedule. Examples include delayed sleep phase type, advanced sleep phase type, irregular sleep–wake type, non-24-hour sleep–wake type, and shift work type. Delayed sleep phase type is the most commonly encountered form among adolescents, as their natural circadian rhythm tends to drift later after puberty and remains delayed through early adulthood. In all cases, circadian rhythm disorders must result in excessive sleepiness and/or insomnia.

Parasomnias

Parasomnias can occur during REM and non-REM sleep. Non-REM parasomnias include somnambulism (sleepwalking), sleep terrors, somniloquy (sleep talking), and sleep-related involuntary movement disorders such as PLMD, body rocking, and bruxism (jaw clenching or tooth grinding throughout the night). The non-REM sleep disorders have many features in common. They are of short duration, lasting somewhere between 1 and 30 minutes; affected individuals do not recall the events subsequently upon awakening due to retrograde amnesia; there is a high

potential for injury to oneself or others; and there is often a personal or family history of such events. Non-REM parasomnias occur during slow-wave deep sleep (e.g., Stage 3). As already discussed, they are more common in childhood than adulthood. Psychopathology among affected children is rare. Precipitating factors include a preexisting sleep problem, sleep deprivation, medications that interrupt or alter sleep architecture, magnesium deficiency, and hormonal factors. There is, in fact, a slight increase in occurrence around puberty.

Somnambulists are typically docile. Some affected individuals begin sleepwalking after an episode of enuresis. Somnambulists may engage in simple behaviors, such as walking into another room and falling back to sleep on the couch, or more complex behaviors, such as getting dressed, taking a walk outside, or preparing and eating food. Sleepwalking episodes that include irrational acts, incoherence, and significant disorientation are called confusional arousals and are considered a variant of sleepwalking. As with all non-REM parasomnias, autonomic arousal is characteristic, as is complete amnesia for the event. Premeditated acts are believed to be impossible, although there have been episodes of life-threatening behavior, murder, and even attempted suicide during these events (Broughton et al., 1994; Guilleminault, Moscovitch, & Leger, 1995; Shatkin, Feinfeld, & Strober, 2002).

The hallmark of a sleep terror is extreme autonomic nervous system activation. A rapid increase in pulse, blood pressure, and heart and respiratory rate, along with profuse sweating, is always observed. Affected children sit bolt upright in bed, scream loudly for a few seconds or minutes, and then promptly fall right back to sleep. They experience complete amnesia for the event and are not harmed in any way.

REM Parasomnias

There are a number of REM parasomnias to which children are sometimes vulnerable as well. The most severe of these, REM sleep behavior disorder, occurs when the body is not adequately paralyzed during REM sleep and is more common among the elderly. Affected individuals commonly act out their dreams, which can result in threatening behavior to themselves and others. Another REM parasomnia, sleep paralysis, occurs when an individual awakens during a REM period while the body is paralyzed. These episodes are highly frightening, as individuals often feel that they are unable to move, breathe, or even open their eyes, yet their brain is actively awake. Finally, nightmares, while frightening, are common and only considered pathological if they occur often (e.g.,

once or more per week) and the sleep disturbance causes daytime functional impairment. It is important to note that nightmares are common in traumatic stress reactions and are often a by-product of anxiety or depression.

Restless Legs Syndrome

Now most often referred to as Willis-Ekbom Disease, RLS represents a neurological disorder with four characteristics: (1) Symptoms are worse at night and are absent or negligible in the morning; (2) there is a strong and often overwhelming need or urge to move to move the affected limb(s), often associated with paresthesias or dysesthesias; (3) the symptoms are triggered by rest, relaxation, or sleep; and (4) the symptoms are relieved with movement. The symptoms can be simply uncomfortable at best but painful at worst.

Enuresis

Bed-wetting or enuresis can occur during both REM and non-REM sleep. Most children are dry during the evening by about 4 or 5 years of age, yet some children take longer to train. For a *DSM-5* diagnosis of enuresis, bed-wetting must occur at least twice a week for at least three months, or it must result in significant distress or functional impairment, and the child must be at least 5 years of age (American Psychiatric Association, 2013). Enuresis is sometimes thought of as either "primary," indicating that the child has never been regularly dry, or "secondary," when enuresis occurs in a child who was previously dry for at least six months. In the *DSM*, enuresis is categorized as an elimination disorder, not a sleep disorder.

TREATMENT

Before engaging in treatment, it is important to obtain a complete sleep history. Key components include how many hours the child sleeps each day (including both naps and evening sleep), when he or she goes to sleep, how long it takes him or her to fall asleep, notable awakenings, and any rituals or practices necessary to put him or her to sleep. Special attention should be paid to difficulties falling asleep (early insomnia), staying

asleep (middle insomnia), and awakening too early (late insomnia). Parents and children should also be asked directly about sleep pathologies, including enuresis, parasomnias, SDB, family history of sleep problems, and any medications or other methods utilized to promote sleep. A sleep diary is often useful for tracking sleep and helping parents to determine their child's precise vulnerabilities. Sleep diaries generally assess sleep patterns and disruptions, exercise, caffeine use, drugs and alcohol, and stressors that can interfere with sleep. Sample sleep diaries are readily available on the Internet.

A useful tool for pediatric clinicians is the BEARS mnemonic. B stands for bedtime problems; E stands for excessive daytime sleepiness; A stands for awakenings during the night; R stands for regularity of evening sleep time and morning awakenings; and S stands for sleep-related breathing problems or snoring. Using the BEARS mnemonic, clinicians have uncovered twice to four times as many sleep problems in comparison to routine clinical examination (Owens & Dalzell, 2005).

Sudden Infant Death Syndrome

Reducing modifiable risk factors for infants, such as sleeping in a prone position, overbundling, and secondary smoke exposure, has decreased the incidence of SIDS by more than 60% in most parts of the world (Halbower & Marcus, 2003). Other strategies, such as having infants sleep in a supine position, not allowing infants to sleep on their sides, and using a pacifier, may ultimately reduce the incidence still further (Alm, Lagercrantz, & Wennergren, 2006).

Narcolepsy

As narcolepsy is a lifelong disorder, extensive education of the affected child and his or her family is of great importance. Methods to increase daytime alertness and enhance psychomotor functioning are also key. Maintaining a regular sleep–wake schedule; avoiding alcohol and drugs; taking one or two brief, planned naps each day; and engaging in regular exercise are helpful strategies. Avoiding driving and other high-risk activities is also advised. Stimulants, such as modafinil (Provigil) and methylphenidate (Ritalin), are often employed to help with wakefulness, and anticholinergic drugs, such as protriptyline (Vivactil) and clomipramine (Anafranil), are often effective for cataplexy (Kotagal, 2008).

Insomnia

The treatment of insomnia, adult or pediatric, should begin with an adequate history and understanding of the environment within which the child sleeps and lives. Certainly, all other potential psychiatric disorders and psychosocial disturbances should be considered in the history, along with any medical illnesses and medications that can interfere with sleep. Proper sleep hygiene, which is often curative for insomnia, should be reviewed with the family and emphasized as a first intervention (see Table 18.1).

The techniques of sleep hygiene, when employed appropriately, are commonly helpful in settling children and adults back to sleep without further need for treatment. The importance of a sleep–wake schedule, particularly for children, cannot be overemphasized. The folk saying "sleep begets sleep" appears to be the experience of most parents. Consequently, if we wish for our children to sleep well, we should be making sure that they receive plenty of opportunity. Establishing a standard bedtime and routine, which for a child may include bathing, reading a book, or engaging in a quiet and comforting family ritual, is often helpful. Allowing the child to fall asleep in the parents' bed or, conversely, parents falling asleep with their children in the child's bed, while commonly enjoyable and comforting for both parents and children, often leaves the child without the confidence necessary to put himself back to sleep when he awakens naturally throughout the night. Consequently, when overused, these methods of putting children to sleep almost invariably result in the child's calling for the parent each time he awakens throughout the night, resulting in unsatisfactory sleep for both.

For those parents who have fallen asleep with their children every night and now find themselves in a maladaptive pattern with which they are frustrated, behavioral methods are very helpful and typically resolve the problem rapidly. One useful methodology involves leaving the child alone in her room for one additional minute each night until the child

Table 18.1 Sleep Hygiene

- Set a routine sleep-wake schedule.
- Encourage regular exercise and physical activity, but not at night.
- Avoid caffeine within six hours of bedtime.
- Invent a relaxing bedtime ritual, such as bathing and reading together.
- Avoid large meals and large amounts of fluid prior to bedtime.
- Adjust the room temperature as desired.
- Keep noise levels low and the bedroom dark. Use a nightlight if necessary.

is able to fall asleep on her own. For example, on Night 1, the parent explains the plan, noting that she is going to help the child to learn to fall asleep on her own. The parent then bids the child good night and leaves the room for 1 minute. The parent then comes back to the room, rejoins the child, and lies with her until she falls asleep, as on any other night. On Night 2, the parent steps out for 2 minutes before lying with the child, and on Night 3, the parent steps out for 3 minutes, and so forth. This method is often effective within a matter of days, as long as the parent is consistent. Because young children are not generally oriented to time, by the fourth or fifth evening, many parents can stay out of the room for 10 minutes or more, and the child by this time will have fallen asleep on her own.

In the event that a child experiences a new onset of insomnia, the parent may find it helpful to soothe the child by sitting with her for a brief period of time, perhaps reading for a few moments or telling a story, before leaving the room once again so that the child can fall asleep. Adults with insomnia are advised not to read in bed but rather to get up and read on the couch or in another room under dim light for 10 to 15 minutes before once again going back to the bed to try to fall asleep. This method is not necessary for children who can be read to in their beds.

Medications are rarely used for pediatric insomnia, and the Food and Drug Administration (FDA) has not approved any such treatments for children suffering from insomnia. Sedatives are rarely necessary, as behavioral methods most always work well. For those children with psychiatric or medical comorbidities that are causing the insomnia, short-half-life medications (e.g., those rapidly metabolized by the body) are sometimes utilized. The medications typically useful in adults with insomnia are rarely employed with children and younger adolescents. Benzodiazepines, such as lorazepam (Ativan), diazepam (Valium), clonazepam (Klonopin), flurazepam (Dalmane), and temazepam (Restoril), are commonly effective for adults with insomnia, as are related agents, such as zaleplon (Sonata), zolpidem (Ambien), and eszopiclone (Lunesta). Barbiturates are almost never given any longer because of their narrow therapeutic index, abuse and addictive potential, and significant side effects. While tolerance to the somnolent effects of benzodiazepines develops in about four weeks, the anxiolytic effects persist. In the long run, then, these medications are often more useful for anxiety than they are for sleep. In children, the GABA receptors, the primary site of action for these medications, are not fully mature until somewhere between the ages of 15 and 18 years, depending on the child. As a result, a significant minority of children who are given benzodiazepines and similar

medications respond paradoxically in a belligerent, agitated, and almost "drunken" manner.

When medications are necessary for the treatment of pediatric insomnia, antihistamines, alpha-2 agonists, and sedating antidepressants are sometimes employed. The antihistamines diphenhydramine (Benadryl), hydroxyzine (Vistaril), and cyproheptadine (Periactin) are all sedating but not without side effects, which can include dry mouth and eyes, tachycardia, urinary retention, paradoxical agitation, confusion, and residual sedation upon awakening, to name just a few. In spite of these side effects, antihistamines are generally well tolerated by children and adolescents. Dosages of both diphenhydramine and hydroxyzine would usually start somewhere between 6.25 and 25 mg, depending on the child; dosages of cyproheptadine would start at between 1 and 2 mg. Perhaps more commonly used, at least among children with ADHD, is the alpha-2 agonist antihypertensive clonidine (Catapres). Clonidine is generally initiated at 0.05 mg at bedtime and can be titrated up to 0.3 mg as needed (see Chapter 3). Sedating antidepressants, such as trazodone (Desyrel) at dosages of 12.5 to 100 mg and mirtazapine (Remeron) at dosages of 7.5 to 15 mg, are also sometimes employed for pediatric insomnia. Increasingly, and perhaps unfortunately, antipsychotics, such as quetiapine (Serzone) and risperidone (Risperdal), are also being used to treat pediatric insomnia, although in the absence of a major psychiatric comorbidity such as bipolar disorder, this type of aggressive treatment is rarely indicated.

Finally, we are beginning to see an influx in the use of herbal medications and dietary supplements, such as melatonin, which has been found effective for treating insomnia in certain groups of children at dosages between 300 mcg and 10 mg. Kava kava, valerian, L-tryptophan, chamomile, passion flower, and lavender are also sometimes marketed and used for pediatric insomnia. With the exception of melatonin, however, which is a reasonable treatment without frequent side effects for most children and adolescents, these medications have not been studied and should be avoided.

Breathing-Related Sleep Disorders

The treatment of OSA and other forms of severe SDB among children typically involves tonsillectomy and adenoidectomy, which almost always resolves the problem. Among adults with OSA, weight loss, sleeping on one's side and stomach (as opposed to the back), and using an air mask that provides continuous positive airway pressure (CPAP) and keeps the airway patent and free of obstruction by the uvula, soft palate, and

tongue are often helpful. In more severe cases, septoplasty to repair a deviated nasal septum or tonsillectomy and adenoidectomy for those with residually enlarged tonsils may be necessary.

Parasomnias

The treatment of non-REM parasomnias involves first a series of psychosocial interventions. Educating the family and patient about the pathology itself is of the utmost importance so that they can make any necessary changes to avoid possible recurrences. Violent episodes, as can occur during a confusional arousal, are rarely repeated. However, somnambulism and sleep terrors do commonly recur. Once educated, the family and patient should identify and then avoid possible precipitants, such as sleep disruption and intermittent sleep deprivation. Disruptions will include loud noises while the child is asleep. Limiting evening fluid intake in an effort to decrease the likelihood of awakening to the cues of bladder fullness is also a commonly employed strategy. Locking windows and doors, removing lethal objects (such as knives) from the child's reach, and even placing a movement sensor on the doorpost of a child's room will help to safeguard the house for an active sleepwalker. For those younger children who sleepwalk or experience frequent sleep terrors, enforcing an afternoon nap may be protective, as naps typically decrease the density of Stage 3 sleep in the evening, during which time these parasomnias occur.

Medications may also be employed in the treatment of non-REM parasomnias but are rarely necessary. Although antidepressants tend to decrease REM density, they have been shown to be helpful in non-REM sleep disorders (Mahowald & Schenck, 1996). Their utility may simply rest upon the fact that they disrupt the normal sleep architecture. Benzodiazepines with long half-lives, such as clonazepam and diazepam, are also sometimes helpful. Benzodiazepines tend to decrease non-REM sleep, in contrast to barbiturates, which tend to decrease REM. As indicated previously, however, some children and adolescents will have a paradoxical reaction to benzodiazepines and cannot tolerate their effects. For these children, antidepressants, such as the SSRIs and trazodone, may be useful.

The REM parasomnias, such as sleep paralysis and nightmares, are generally treated simply with psychoeducation. Neither is life threatening, and rarely do they result in significant functional impairment. For those rare cases of REM sleep behavior disorder, a board-certified sleep specialist should be consulted immediately.

Enuresis

The etiology of enuresis is likely to be multifactorial and includes difficulties with bladder muscular stability, central nervous system arousability, pontine reflex function, internal sphincter tone, functional bladder capacity, and nocturnal urine production and a maturational delay in antidiuretic hormone (ADH) secretion, which inhibits urination. The final factor is perhaps the most important, as numerous medications seem to work at this level. Affected individuals probably either do not produce sufficient ADH or do not respond adequately to the ADH that they do produce, resulting in enuresis. Secondary enuresis is commonly caused by urinary tract infections, diabetes mellitus, and in some cases psychological factors.

The treatment of enuresis, as with all sleep disorders, begins with a full and complete history. Any prior treatment efforts, behavioral or otherwise, should be ascertained. Education is then provided for the family and patient. Enuresis commonly occurs within families and is more often seen in males than females. Most children will outgrow enuresis by 10 to 12 years of age, and about 12% to 16% of children become asymptomatic each year, even without treatment. Consequently, education rests upon supporting the family, helping them to consider behavioral strategies that may be useful, and emphasizing that the family should not blame, embarrass, or shame the child.

Behavioral treatment efforts begin by discontinuing all caffeine and alcohol use within six hours of bedtime, as both will inhibit ADH production. Restricting late-night fluid intake to less than 4 ounces of liquid after dinner is also commonly employed, although we have no data to support this practice. Some families find it useful to briefly awaken the child just before the parents go to bed, place him on the toilet, and run the tap water in order to stimulate the flow of urine. Allowing the child to void in this manner before placing him back to bed is often helpful in decreasing early-morning enuresis.

The "bell and pad" or bed-wetting alarm has the highest effective treatment rate and the lowest relapse rate of the behavioral methods (Thiedke, 2003). This practice employs a moisture-sensitive monitor, often a pad placed atop the mattress or smaller monitors placed on the child's underwear, which sounds a loud alarm if the child wets. Once the alarm is triggered, the parents can help the child get to the bathroom to urinate. This method typically takes about three to four weeks to work. Some children will naturally relapse after achieving nighttime bladder control, but if the bell-and-pad method is used subsequently, they can

generally be easily retrained. Other behavioral treatments have not been as consistent in their utility; these include training to increase the functional capacity of the bladder to hold urine; reward systems for children who successfully sleep through the night without urinating in the bed; cognitive and motivational therapies; pelvic floor muscle training; and biofeedback (Abdelghany et al., 2001; Glazener & Evans, 2002; Robson & Leung, 2002; Van Kampen et al., 2002; Yeung, 2003).

The most commonly utilized medication for the treatment of enuresis is desmopressin acetate (DDAVP), a synthetic ADH analog. Dosages typically range between 0.1 and 0.6 mg per evening. Concerns about hyponatremia (low blood sodium) that has resulted in seizures among a small number of children who have received the intranasal form only have recently prompted the FDA to issue a warning advising against treating children with intranasal DDAVP for enuresis.

Other common medications for the treatment of enuresis include the tricyclic antidepressants (TCAs), in particular imipramine (Tofranil). Although most commonly used to treat adult depression, at dosages of 25 to 50 mg, imipramine is often effective for the treatment of enuresis in children and adults. The anticholinergic effects are clearly not the reason for the antienuretic effects, given the fact that other anticholinergic medications are not generally helpful for enuresis. Some suggest that children with enuresis excrete a smaller amount of ADH during sleep and that imipramine restores normal levels of nocturnal ADH secretion (Tomasi, Siracusano, Monni, Mela, & Delitala, 2001). Whenever treating children with TCAs, however, as discussed in Chapter 12, routine electrocardiograms must be performed before and during treatment. Although the dosage of imipramine employed in treating enuresis is much lower than that used to treat depression and is therefore likely to be considerably safer, cardiac parameters must still be followed.

Various antispasmodics are useful for adults who suffer enuresis. These medications include oxybutynin (Ditropan) at a dosage of 2.5 to 5 mg per evening or tolterodine (Detrol) at a dosage of 0.5 to 1 mg per evening. We generally try not to use these medications in children, however, as they can cause excessive sedation and even confusion. In children with particularly difficult-to-treat enuresis, we may sometimes combine treatments, such as desmopressin acetate plus imipramine or oxybutynin. More recently studies have found that atomoxetine (Strattera), an ADHD treatment, is also effective for enuresis. This serendipitous finding was first reported in a case series (Shatkin, 2004) and has now been replicated in a randomized, double-blind, placebo-controlled trial (Sumner, Schuh, Sutton, Lipetz, & Kelsey, 2006).

Treating Sleep Problems Associated With Psychiatric Conditions

As previously noted, many children with ADHD have difficulties with falling asleep or staying asleep. Treatment for these children should begin by reviewing proper sleep hygiene with the parents. Stimulant medications used to treat ADHD also commonly cause sleep impairments. If a stimulant is the cause of the insomnia, the practitioner should consider lowering the dosage of the stimulant or changing to another preparation, perhaps a shorter-acting medication. Paradoxically, for some children with ADHD, adding a low dose of stimulant in the evening may help them to settle to sleep by decreasing their hyperactivity. Changing to a nonstimulant, such as atomoxetine, or using adjunctive agents, particularly clonidine but sometimes sedating antihistamines, antidepressants, or melatonin, is also often useful.

Children with autism spectrum disorders (ASD) often fail to recognize environmental and social cues indicating bedtime. These children may also suffer from poorly developed circadian rhythms because of their social deficits, altered melatonin production, and abnormalities in the hypothalamic-pituitary-adrenal axis (Kulman et al., 2000; Nir et al., 1995; Wiggs & Stores, 1998). Regardless, many of these children require help getting to sleep. As with children diagnosed with ADHD, proper sleep hygiene should be the first intervention. Chronotherapy, or systematically delaying bedtime each night until an age-appropriate bedtime is reached, is sometimes helpful (Piazza, Hagopian, Hughes, & Fisher, 1998). Unstudied medications, but those often utilized for sleep in these children, may include antihistamines, sedating antidepressants, clonidine, benzodiazepines, and antipsychotics. As stated above, melatonin has been studied in small numbers of children affected with developmental disabilities and ASD and has been found effective (Garstang & Wallis, 2006).

Children with depression often exhibit a decreased REM latency, increased total REM, and increased sleep-onset time, all of which tend to dissipate for most children once the depression is treated (Emslie, Rush, Weinberg, Rintelmann, & Roffwarg, 1990). Beyond sleep hygiene and treating all comorbid conditions, no clear data exist on whether or not to treat the symptom of insomnia independent from the mood disorder. For milder cases, a combination of improved sleep hygiene and cognitive behavior therapy (CBT) has been proven effective in managing the insomnia and awakenings associated with depression (Ivanenko et al., 2004). In more severe cases, effective drug therapy may require a combination of an antidepressant with the short-term use of a sedative or

hypnotic. Borrowing from adult studies, at the very least practitioners should aggressively treat insomnia associated with bipolar disorder, as a decreased need for sleep is one of the earliest and cardinal symptoms of mania.

The treatment of sleep difficulties in children and adolescents with anxiety disorders involves identifying and treating the primary psychiatric disorder, utilizing sleep hygiene, and then medications as indicated. As with depression, it is not clear how much benefit is gained from treating the symptom of insomnia as a separate entity.