Polysomnography

Definition

The word polysomnography, derived from the Greek roots “poly,” meaning many, “somno,” meaning sleep, and “graphy” meaning to write, refers to multiple tests performed on patients while they sleep. Polysomnography is an overnight test to evaluate sleep disorders. Polysomnography generally includes monitoring of the patient’s airflow through the nose and mouth, blood pressure, electrocardiographic activity, blood oxygen level, brain wave pattern, eye movement, and the movement of respiratory muscle and limbs.

Purpose

Polysomnography is used to help diagnose and evaluate a number of sleep disorders. For instance, it can help diagnose sleep apnea, a common disorder in middle-aged and elderly obese men, in which the muscles of the soft palate in the back of the throat relax and close off the airway during sleep. This may cause the person to snore loudly and gasp for air at night, and to be excessively sleepy and doze off during the day. Another syndrome often evaluated by polysomnography is narcolepsy. In narcolepsy, people have sudden attacks of sleep and/or cataplexy (temporary loss of muscle tone caused by moments of emotion, such as fear, anger, or surprise, which causes people to slump or fall over), sleep paralysis or hallucinations at the onset of sleep. Polysomnography is often used to evaluate parasomnias (abnormal behaviors or movements during sleep), such as sleep walking, talking in one’s sleep, nightmares, and bedwetting. It can also be used to detect or evaluate seizures that occur in the middle of the night, when the patient and his or her family are unlikely to be aware of them.

Comment [1]: as discussed in the previous article, it can cause dangerous attacks

Comment [2]: can also emerge in children due to regression

Precautions

Polysomnography is extremely safe and no special precautions need to be taken.

Description

Polysomnography requires an overnight stay in a sleep laboratory. During this stay, while the patient sleeps, he or she is monitored in a number of ways that can provide very useful information.

One form of monitoring is electroencephalography (EEG), in which electrodes are attached to the patient's scalp in order to record his or her brain wave activity. The electroencephalograph records brain wave activity from different parts of the brain and charts them on a graph. The EEG not only helps doctors establish what stage of sleep the patient is in, but may also detect seizures.

Another form of monitoring is continuous electro-oculography (EOG), which records eye movement and is used to determine when the patient is going through a stage of sleep called rapid-eye-movement (REM) sleep. Both EEG and EOG can be helpful in determining sleep latency (the time that transpires between lights out and the onset of sleep), total sleep time, the time spent in each sleep stage, and the number of arousals from sleep.

The air flow through the patient's nose and mouth are measured by heat-sensitive devices called thermistors. This can help detect episodes of apnea (stopped breathing), or hypnopea (inadequate breathing). Another test called pulse oximetry measures the amount of oxygen in the blood, and can be used to assess the degree of oxygen starvation during episodes of hypnopea or apnea.

The electrical activity of the patient's heart is also measured on an electrocardiogram, or ECG. Electrodes are affixed to the patient's chest and they pick up electrical activity from various areas of the heart. They help detect cardiac arrythmias (abnormal heart rhythms), which may occur during periods of sleep apnea. Blood pressure is also measured: sometimes episodes of sleep apnea can dangerously elevate blood pressure.

In some cases, sleep laboratories monitor the movement of limbs during sleep. This can be helpful in detecting such sleep disorders as periodic limb movements.

Preparation

The patient may be asked to discontinue taking any medications used to help him/her sleep. Before the patient goes to sleep, the technician hooks him or her up to all of the monitors being used.

Comment [3]: measure brain wave activity

Comment [4]: Dr. Dike notes on EEG

Comment [5]: looks into REM

Aftercare

Once the test is over, the monitors are detached from the patient. No special measures need to be taken after polysomnography.

Results

A normal result in polysomnography shows normal results for all parameters (EEG, ECG, blood pressure, eye movement, air flow, pulse oximetry, etc.) monitored throughout all stages of sleep.

Abnormal results

Polysomnography may yield a number of abnormal results, indicating a number of potential disorders. For instance, abnormal transitions in and out of various stages of sleep, as documented by the EEG and the EOG, may be a sign of narcolepsy. Reduced air flow through the nose and mouth, along with a fall in oxygenation of the blood, may indicate apnea or hypopnea. If apnea is accompanied by abnormalities in ECG or elevations in blood pressure, this can indicate that sleep apnea may be particularly harmful. Frequent movement of limbs may indicate a sleep disorder called periodic limb movement.

Organizations

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Dinsmoor, Robert Scott. "Polysomnography." *The Gale Encyclopedia of Medicine*, edited by Jacqueline L. Longe, 5th ed., Gale, 2015. *Science In Context*, http://link.galegroup.com/apps/doc/RMVQCZ085158757/SCIC?u=j043905010&sid=SCIC&xid=08958f7d. Accessed 10 Oct. 2018.

Sleep

Sleep is a state of physical inactivity and mental rest in which conscious awareness, thought, and voluntary movement cease and intermittent dreaming takes place. This natural and regular phenomenon essential to all living creatures normally happens with the eyes closed and is divided into two basic types: REM (rapid eye movement) and NREM (non-rapid eye movement) sleep. As passive as sleep appears, it is actually a very active and deliberate process in which the brain busily turns off wakeful functions while turning on sleep mechanisms. No one knows exactly why humans, and other animals, must sleep or how it happens, but the quality, quantity, and type of sleep impacts the quality, quantity, and effectiveness of our wakeful mental and physical activities. These, in turn, influence the quality, quantity, and timing of sleep.

Comment [1]: what animals sleep with eyes open? And how do they protect their vital organs?

Comment [2]: lots of uncertainty regarding sleep

Beliefs, theories, and scientific observations of sleep

At one time, it was believed that the mind simply turned off during sleep, or that the soul left the body during sleep. Greek philosopher Aristotle (384–322 BC) thought that the digestion of food created vapors that naturally rose upward, causing the brain to become drowsy. Dreams—the only part of sleep the sleeper actually experiences—were often interpreted as prophetic revelations. Today, dream interpretation is used in some psychoanalytic and self-awareness activities for personal insight and revelation.

Comment [3]: Freud said the unconscious mind becomes active during sleep

Despite the fact that most people spend more time sleeping than in any other single activity, scientists still lack much knowledge about why humans need sleep or what triggers it. Serious scientific studies only began a little over 50 years ago, and several different theories have been developed, none of which have been proven. It is known, however, that the higher the organism on the evolutionary chain (humans being the highest) the more important sleep becomes.

According to the restorative theory of sleep, body tissues heal and regenerate during non-REM sleep and brain tissue heals during REM sleep. This theory seems generally accepted for brain tissue restoration, particularly in the cerebral cortex, which cannot rest during the waking state. However, some researchers question its validity regarding body tissue restoration, believing that sleep simply acts as an immobilizer, forcing the body to rest, with rest and nourishment being the actual restorative factors. The release during sleep of growth hormones, testosterone, and other anabolic (constructive) hormones leads some experts to support the restorative theory, while others believe this release is coincidental to, and not caused by, sleep.

Comment [4]: why many people say to "sleep off a sickness"

Comment [5]: the brain obi cannot heal when it is active, so needs a certain time to restore

The energy conservation theory of sleep notes that animals that burn energy quickly and produce their own body heat, such as humans do, sleep more than those with slow metabolisms (energy consumption) or that do not produce body heat (snakes, for instance). This theory is based upon the observation that metabolic rates decrease during slow-wave sleep—the last two stages of the four-stage, NREM sleep cycle and that some researchers believe is the most important stage.

According to the adaptive theory of sleep, sleep encourages adaption to the environment for increased chances of survival. Animals such as cats that spend little time searching for food and have few natural enemies may sleep 15 hours a day for long periods. Grazing animals like buffaloes and horses, which spend many hours foraging and which are at risk from natural predators, sleep only two to four hours a day in short spurts. Proponents of the adaptive theory believe early humans slept in caves to protect themselves from night-stalking animals.

Because instinct plays an important role in the survival of any species, including humans, the instinct theory presumes sleep, like mating or hunger, is a survival instinct.

Studies show that new information is best retained when introduced just before sleep begins and retained less well after waking or if REM sleep is interrupted. These observations lead to the memory consolidation theory of sleep. REM sleep seems to play an important role in storing information.

Why humans sleep and how it is triggered

Enforced sleep-deprivation experiments

In the attempt to understand human need for sleep, experiments in sleep deprivation play an important role. Total sleep deprivation longer than 40 hours proves impossible, however, due to brief, totally unpreventable periods of microsleep that will happen even during physical activity. These microsleeps barely last a few seconds, but they may explain performance lapses in waking activities. They demonstrate the body's obvious need for sleep and may even have some restorative function.

While sleep deprivation can eventually cause death, sleep deprivation lasting up to ten days shows no serious, prolonged consequences and does not cause severe psychological problems or mental illness as once thought. In 1965, for example, 17-year-old Randy Gardner decided to attempt a new world record for total sleep deprivation as his high school science fair project. He succeeded in staying awake for an incredible 264 hours. When researchers and psychiatrists from Stanford University (California) heard of Gardner's experiment, they rushed to the scene and monitored his progress. On the last night, one researcher took Randy to an arcade to keep him awake. Randy won every game, indicating that prolonged sleep deprivation did not seriously impair his physical or psychomotor functioning. After his extraordinary vigil, Randy slept just 14 hours and 40 minutes, awoke naturally around 10:00 P.M., stayed awake 24 hours, and slept a normal eight hours. Follow-up over the years has shown that Gardner suffered no adverse effects from his experience. Scientific studies in the 1990s and 2000s, however, show that such sleep deprivation activities are likely dangerous to human health.

Losing more than one night's sleep does produce a noticeable increase in irritability, lethargy, disinterest, and even paranoia. While not seriously impaired, psychomotor performance and concentration are adversely affected. While autonomic (involuntary) nervous system activity increases during sleep deprivation to keep heart rate, blood pressure, breathing, and body temperature normal, physical fitness cannot be maintained and immunological functions seem to suffer.

Comment [6]: such methods of torture have been used

Comment [7]: this proves the other theories wrong... and it also sets back when you go to sleep

Biological determinants of sleep

Another question which remains only partially answered is how sleep onset is determined and why. The factors involved include circadian rhythms (biological time clocks); the degree of stimulation in the wakeful state; the degree of personal sleepiness; the decrease in core body temperature; a quiet and comfortable sleep environment; conditioning arising from bedroom cues; and homeostasis, the automatic attempt by the body to maintain balance and equilibrium (for example, the air temperature may fall to 50°F [10°C], but the human body burns calories to maintain its normal temperature of 98.6°F [37°C]).

The fact that sleep deprivation increases the desire for sleep firmly points to a homeostatic element in sleep. This is intricately linked to highly influential circadian rhythms controlled by centers probably

located in the hypothalamus, part of the brain primarily involved in autonomic nervous system functions. Circadian rhythms determine the human approximate 24- to 25-hour sleep-wake pattern and a similar cycle in the rise and fall of core body temperature and other physiological functions.
It is not yet known whether two separate biological clocks influence sleep-wake cycles and temperature levels and, if so, if a single control clock regulates them both. However, body temperature drops slightly in the evening as sleep draws near, reaches its lowest point around 2:00 to 4:00 A.M., rises slightly before awakening, and increases to maximum as the day progresses. This pattern is not a result of being asleep or awake, for body temperature does not drop during daytime naps nor does it rise at night after a sudden change in sleep schedule, such as shift work. It takes about two weeks for circadian rhythms controlling temperature levels to get back into sync with sleep-wake states.
Studies done on human circadian rhythms in situations totally devoid of time cues (such as sunrise, sunset, clocks, etc.) show that these rhythms are controlled completely internally and usually run on a cycle of almost 25 rather than 24 hours. In normal situations, factors called zeitgebers (from the German *zeit* for time and *geber* for giver) such as daylight, environmental noises, clocks, and work schedules virtually force humans to maintain a 24-hour cycle. Therefore, human circadian rhythms must phase advance from their normal, approximate 25-hour cycle to an imposed 24-hour cycle. The body has difficulty adapting to much more than an hour of phase-advance in one day. Drastic time changes—like those caused by rapid long-distance travel such as flying—require either phase-advancement or phase-delay. This is why air travelers experience jet lag. Recovery from east-west travel requiring phase-delay adjustments is usually quicker than in phase-advancement resulting from west-east travel. Some people seem simply unable to phase-advance their biological clocks, which often results in sleep disorders.
Light pollution at night, such as occurs in major cities throughout the world, can also affect circadian rhythms that help cue sleep. Studies have linked working the night shift and exposure to light at night, for example, to several types of cancer, diabetes, heart disease, and obesity, as well as sleep disruption. Exposure to newer high color-temperature blue LED streetlights, recently installed in many large cities for energy efficiency, suppresses melatonin about twice as long as traditional streetlights, and shifts circadian rhythms by twice as much (3 hours vs. 1.5 hours). As a result, some cities are already replacing their LED streetlights. To counter excess blue light exposure at night and promote healthy sleep, guidelines from the Harvard School of Public Health recommend using dim red lights for nightlights, avoiding bright computer or other screens 2–3 hours before bedtime, installing applications on electronics that filter blue/green wavelength at night, wearing blue-light blocking glasses if working the night shift, and frequent exposure to bright light in the daytime.

The structure of sleep

Measurement of electrical impulses in the sleeping brain

The greatest contribution to sleep study was the development of the EEG, or electroencephalogram, by German psychiatrist Hans Berger (1873–1941)in 1929. This electrode, attached to the scalp with an adhesive, records electrical impulses in the brain called brain waves. The discovery triggered investigations into sleep in major centers around the world. Specific brain wave patterns became evident and sleep was generally classified into distinct stages.
In 1953, Professor Nathaniel Kleitman and his graduate student Eugene Aserinsky reported their close observations of a sleep stage they called REM-rapid eye movement. An electro-oculogram, or

Comment [8]: body temp is directly related with level of being awake

Comment [9]: this 25 hour cycle would mean that traditionally, one hour a day would be lost

Comment [10]: sleeping more is easier than sleeping less

Comment [11]: could look into whether or not people struggle with more insomnia if they are of higher socioeconomic status (bc more phones and blue light exposure)

Comment [12]: study brain wave patterns

EOG, taped close to the eyelids, recorded both vertical and horizontal eye movement, which became rapid and sporadic during REM sleep. The electromyogram, or EMG, recorded chin and neck muscle movement which, for as yet undetermined reasons, completely relaxed during REM sleep. Kleitman and Aserinsky found that when subjects were awakened from REM sleep they almost always reported a dream, which was seldom the case when awakened from non-REM sleep. Following the initial REM discoveries, sleep research greatly increased. One important discovery arising from this research was the high prevalence of sleep disorders, some of which now explain problems previously blamed on obscure physical or psychological disorders but which could not be effectively treated by medicine or psychiatry.

Comment [13]: explains why some people remember their dreams and some people don't

Combined, the EEG, EOG, and EMG produce a fascinating picture of sleep's structure. These monitoring devices transfer electronic stimulus to recording devices, or on to paper. The number of complete brain wave cycles per second (frequency) is measured in units of hertz (Hz) by the EEG. The difference between the highest and lowest point of each wave (the peak and trough) is measured in amplitude, (millionths of a volt, or microvolts [uV]). As sleep approaches and deepens, frequency decreases and amplitude increases.

Stages of sleep

Very specific rhythms occur in different stages of the sleep-wake cycle. Beta rhythms are fast, low voltage waves (usually above 15 Hz and below 10 uV) which appear in alert, wakeful states. In the quiet, restful wakeful state prior to sleep onset, or in relaxed meditative state with the eyes closed, the brain displays alpha rhythms of about 8 to 11 Hz and 50 uV. Fairly high chin muscle activity and slow, rolling eye movements are recorded. Alpha waves disappear with visual imagery or opening the eyes, which causes alpha blocking.

Non-REM sleep is generally believed to occur in four stages and is characterized by lack of dreaming. As the sleeper enters the drowsy, light sleep of stage 1, theta rhythms, ranging between 3.5 to 7.5 Hz with a lower voltage, appear. The sleeper is generally non-responsive during this stage, which takes up about 5 percent of the sleep cycle, but is easily awakened. Once again, high chin muscle activity occurs and there is occasional slow, rolling eye movement.

Comment [14]: stage 1: light sleep
stage 2: brain waves are slower
stage 3: low frequency/ high voltage delta waves
stage 4: slower frequency higher voltage delta wave

Within a few minutes, the sleeper enters stage 2 sleep. Brain waves slow even further and spindles (short bursts of electrical impulses at about 12 to 14 Hz which increase and decrease in amplitude) appear, along with K-complexes (sharp, high voltage wave groups, often followed by spindles). These phenomena may be initiated by internal or external stimuli or by some as yet unknown source deep within the brain. A few delta waves may appear here. This portion of sleep occupies about 45 percent of the sleep cycle.

Normally, stage 3 sleep, comprised of 20 to 50 percent low frequency/high voltage delta waves, follows stage 2 as a short (about 7 percent of total sleep) transition to stage 4 sleep, which shows slower frequency higher voltage delta wave activity above 50%. There is virtually no eye movement during stages 2, 3, and 4.

In stage 4 sleep, some sleep spindles may occur, but are difficult to record. This stage occupies about 13 percent of the sleep cycle, seems to be affected more than any other stage by the length of prior wakefulness, and reflects the most cerebral shutdown. Accordingly, some researchers believe this stage to be the most necessary for brain tissue restoration. Usually grouped together, stages 3 and 4 are called delta, or slow wave sleep (SWS), and is normally followed by REM sleep.

The sleep cycle from stage 1 through REM occurs three to five times a night in a normal young adult. Stages 3 and 4 decrease with each cycle and stage 2 and REM sleep occupy most of the last

half of the night's sleep. Time spent in each stage varies with age, and age particularly influences the amount time spent in SWS. From infancy to young adult, SWS occupies about 20 to 25 percent of total sleep time and perhaps as little as 5 percent by the age of 60 years. This loss of time is made up in stage 1 sleep and wakeful periods.

The period comprised of the four stages between sleep onset and REM is known as REM latency. REM onset is indicated by a drop in amplitude and rise in frequency of brain waves. The subject's eyes flicker quickly under the eyelids, dream activity is high, and the body seems to become paralyzed because of the decrease in skeletal muscle tone. After REM, the subject usually returns to stage 2 sleep, sometimes after waking slightly. REM sleep occurs regularly during the night. The larger the brain, the longer the period between REM episodes—about 90 minutes for humans and 12 minutes in rats.

REM sleep is triggered by neural functions deep within the brain, which releases one type of neurotransmitter (chemical agent) to turn REM sleep on and another to turn it off. Whereas autonomic activity (such as breathing and heart rate) slows and becomes more regular during non-REM sleep, it becomes highly irregular during REM sleep. Changes in blood pressure, heart rate, and breathing regularity take place, there is virtually no regulation of body temperature, and clitoral and penile erections are often reported. Most deaths, particularly of ill or aged individuals, happen early in the morning when body temperature is at its lowest and the likelihood of REM sleep is highest.

Sidebar: Hide

KEY TERMS

Alpha/beta/delta/theta rhythms

Brain wave activity occurring in different stages of wakefulness or sleep identified by amplitude and frequency.

Amplitude

Difference between the highest and lowest point of a wave.

Autonomic nervous system

The part of the nervous system that controls involuntary processes, such as heart beat, digestion, and breathing.

Circadian rhythms

The rhythmical biological cycle of sleep and waking which, in humans, usually occurs every 24 hours.

Homeostasis

The body's automatic attempt to maintain balance and stability of certain internal functions, such as body temperature, influenced by the external environment.

Metabolism

Chemical changes in body tissue which convert nutrients into energy for use by all vital bodily functions.

Phase advance/phase delay

Adjustment of circadian rhythms from their internal, biologically controlled cycle of approximately 25 hours to the 24-hour-a-day cycle imposed by the Sun.

REM activity is seen in the fetus as early as six months after conception. By the time of birth, the fetus will spend 90 percent of its sleep time in REM but only about half that after birth. REM constitutes about 20 to 30 percent of a normal young adult's sleep, decreasing with age. These observations support one of several theories about our need for REM sleep which suggests that, to function properly, the central nervous system requires considerable stimulation, particularly during development. Because it receives no environmental stimulation during the long hours of sleep, it is possible that the high amount of brain wave activity in REM sleep provides the necessary stimulation.

Comment [15]: sleep in the womb as well

The 2017 Nobel Prize in Physiology or Medicine was jointly awarded to three American researchers, Jeffrey C. Hall, Michael Rosbash and Michael W. Young for "their discoveries of molecular mechanisms controlling the circadian rhythm."

Thompson, Marie L. "Sleep." *The Gale Encyclopedia of Science*, edited by K. Lee Lerner and Brenda Wilmoth Lerner, 5th ed., Gale, 2014. *Science In Context*, http://link.galegroup.com/apps/doc/CV2644032036/SCIC?u=j043905010&sid=SCIC&xid=835da8e3. Accessed 10 Oct. 2018.

Sleep Disorders

Sleep disorders are chronic sleep irregularities, which drastically interfere with normal nighttime sleep or daytime functioning. There are about 70 different sleep disorders. Sleep-related problems are the most common complaint heard by doctors and psychiatrists, the two most common being insomnia (inability to go to sleep or stay asleep), and hypersomnia (excessive daytime sleepiness). While most people experience both problems at some time, it is only when they cause serious intrusions into daily living that they warrant investigation as disorders.

Although sleep is a basic behavior in animals as well as humans, researchers still do not completely understand it. In the past 60 years, however, researchers have learned about the pattern of different types of sleep and its effects on breathing, heart rate, brain waves, and so on. Sleep disorders research, as a relatively new field of medicine, was stimulated by the discovery in 1953 of REM (rapid eye movement) sleep and the more recent discovery in the 1980s that certain irregular breathing patterns during sleep can cause serious illness and sometimes death. While medical knowledge of sleep disorders is expanding rapidly, clinical educational programs still barely touch on the subject, about which many physicians, psychiatrists and neurologists remain seriously undereducated.

Insomnias and hypersomnias

Insomnias include problems with sleep onset (taking longer than 30 minutes falling asleep), sleep maintenance (waking five or more times during the night or for a total of 30 minutes or more), early arousal (less than 6.5 hours of sleep over a typical night), light sleep, and conditioning (learning not to sleep by associating certain bedtime cues with the inability to sleep). Insomnias may be transient (lasting no longer than three weeks) or persistent. Most people experience transient insomnias, perhaps due to stress, excitement, illness, or even a sudden change to high altitude. These are treatable by short-term prescription drugs and, sometimes, relaxation techniques. When insomnia becomes persistent, it is usually classed as a disorder. Persistent insomnias may result from medical and/or psychiatric disorders, prescription drug use, and substance abuse, and often result in chronic fatigue, impaired daytime functioning, and hypersomnia.

Hypersomnias manifest as excessive daytime sleepiness, uncontrollable sleep attacks, and, in the extreme, causes people to fall asleep at highly inappropriate times, such as driving a car or when holding a conversation. Most hypersomnias, like narcolepsy and those associated with apnea (breathing cessation), are caused by some other disorder and are therefore symptomatic. Some, however, like idiopathic central nervous system (CNS) hypersomnia and Kleine-Levin syndrome, are termed idiopathic for their unknown origin. CNS hypersomnia causes a continuous state of sleepiness from which long naps and nighttime sleep provides no relief. This is usually a life-long disorder and treatment is still somewhat experimental and relatively ineffective. Kleine-Levin syndrome is a rare disorder seen three times as often in males as females, beginning in the late teens or twenties. Symptoms are periods of excessive sleepiness, excessive overeating, abnormal behavior, irritability, loss of sexual inhibition, and sometimes hallucinations. These periods may last days or weeks, occur one or more times a year, and disappear about the age of 40 years. Behavior between attacks is normal, and the sufferer often has little recall of the attack. Stimulant drugs may reduce sleepiness for brief periods, and lithium meets with some success in preventing recurrence.

Comment [1]: the more intense the issue, the more serious the causes are

Comment [2]: bc not many treatments or research options available

Observation and classification of sleep disorders

Sleep abnormalities intrigued even the earliest medical writers who detailed difficulties that people experienced with falling asleep, staying asleep, or staying awake during the day. By 1885, Henry Lyman, a professor of neurology in Chicago, Illinois, classified insomnias into two groups: those resulting from either abnormal internal or physical functions; or from external, environmental influences. In 1912, Sir James Sawyer reclassified the causes as either medical; or psychic, toxic, or senile. Insomnias were divided into three categories in 1927: inability to fall asleep, recurrent waking episodes, and waking earlier in the morning than appropriate. Another reclassification, also into three categories, was made in 1930: insomnia/hypersomnia, unusual sleep-wake patterns, and parasomnias (interruption of sleep by abnormal physical occurrences). One change to that grouping was made in 1930 when hypersomnias and insomnias became separate categories.

Intense escalation of sleep study in the 1970s saw medical centers begin establishing sleep disorder clinics where researchers increasingly uncovered abnormalities in sleep patterns and events. It was during this decade that sleep disorders became an independent field of medical research and the increasing number of sleep disorders being identified necessitated formal classification.

Dyssomnias

This group includes both insomnias and hypersomnias, and is divided into three categories: intrinsic, extrinsic, and circadian rhythm sleep disorders. Intrinsic sleep disorders originate within the body and include narcolepsy, sleep apnea, and periodic limb movements.

Narcolepsy is associated with REM sleep and the central nervous system. It causes frequent sleep disturbances and thus excessive daytime drowsiness. Subjects may fall asleep without warning, experience cataplexy—muscle weakness associated with sudden emotional responses like anger, which may cause collapse—and temporarily be unable to move immediately before falling asleep or just after waking up. While narcolepsy is manageable clinically and brief naps of 10 to 20 minutes may be somewhat refreshing, there is no cure.

Apnea is the brief cessation of breathing. obstructive sleep apnea is caused by the collapse of the upper airway passages that prevent air intake, while central apnea occurs when the diaphragm and chest muscles cease functioning momentarily. Both apneas result in a suffocating sensation, which goes unnoticed but causes enough arousal to enable breathing to begin again. Bed partners report excessive snoring and repeated brief pauses in breathing. Apneas may disrupt sleep as many as several hundred times a night, naturally resulting in excessive daytime sleepiness. Severe episodes can actually cause death, usually from heart failure. Treatment for obstructive apnea includes pumping air through a nasal mask to keep air passages open, while some success in treating central apnea can be obtained with drugs and mechanical breathing aids.

Periodic limb movement (PLM) and restless leg syndrome (RLS) result in sleep disruptions and therefore hypersomnia. PLM occurs during sleep and subjects experience involuntary leg jerks (sometimes arms also). The subject is unaware of these movements but bed partners complain of being kicked and hit. In RLS, crawling or prickling sensations seriously interfere with sleep onset. Although their causes are yet unknown, certain drugs, stretching, exercise, and avoiding stress and excessive tiredness seem to provide some relief.

Extrinsic sleep disorders are caused by external influences such as drugs and alcohol, poor sleep hygiene, high altitude, and lack of regular sleep limit-setting for children.

Comment [3]: the brain and the spinal cord

Comment [4]: can lead to marital issues

Drug- and alcohol-related sleep disorders result from stimulant, sedative, and alcohol use, all of which can affect, and severely disrupt, the sleep-wake schedule. Stimulants, including amphetamines, caffeine, and some weight loss agents, can cause sleep disturbances and may eventually result in the need for excessively long periods of sleep. Prolonged use of sedatives, including sleeping pills, often result in severe rebound insomnia and daytime sleepiness. Sudden withdrawal also produces these effects. Alcohol, while increasing total sleep time, also increases arousal, snoring, and the incidence and severity of sleep apnea. Prolonged abuse severely reduces REM and delta (slow-wave) sleep, and sudden withdrawal results in severe sleep-onset difficulties, significantly reduced delta sleep, and REM rebound, causing intense nightmares and anxiety dreams for prolonged periods.

Circadian rhythm sleep disorders either affect or are affected by circadian rhythms, which determine human's approximate 25-hour biological sleep-wake pattern and other biological functions. Disorders may be transient or permanent.

Jet-lag and shift work-related circadian rhythm disorders are transient. Because the human biological clock runs slightly slower than the 24-hour solar clock, it must adjust to external time cues like alarm clocks and school or work schedules. Circadian rhythms must therefore phase-advance to fit the imposed 24-hour day. The body has difficulty phase-advancing more than one hour each day, therefore people undergoing drastic time changes after long-distance air travel suffer from jet lag. Hypersomnia, insomnia, and a decrease in alertness and performance are not uncommon and may last up to ten days, particularly after eastward trips longer than six hours. Night-shift workers, whether permanent or alternating between day and night shifts, experience similar symptoms, which may become chronic because circadian rhythms induce maximum sleepiness during the sun-clock's night and alertness during the sun-clock's day, regardless of how long a person works nights.

Light pollution at night, such as occurs in major cities throughout the world, can also disturb the circadian rhythms that help cue sleep. Studies have shown that exposure to newer high color-temperature blue LED streetlights, recently installed in many large cities for energy efficiency, suppresses melatonin about twice as long as traditional streetlights. Blue LED light shifts circadian rhythms by twice as much (3 hours vs. 1.5 hours) as softer yellow lighting. As a result, some cities are already replacing their LED streetlights. To counter excess blue light exposure at night and promote healthy sleep, guidelines from the Harvard School of Public Health recommend using dim red lights for nightlights, avoiding bright computer or other screens 2–3 hours before bedtime, installing applications on electronics that filter blue/green wavelength at night, wearing blue-light blocking glasses if working the night shift, and frequent exposure to bright light in the daytime.

Delayed sleep phase syndrome is a chronic condition in which waking to meet normal daily schedules is extremely difficult. Such people are often referred to as night people because they feel alert late in the day and at night while experiencing fatigue and sleepiness in the mornings and early afternoons. This is because their biological morning is the middle of the actual night. Phase-delaying the sleep-wake schedule by going to bed three hours later and sleeping three hours longer until the required morning arousal time is reached, can often synchronize the two. Exposure to artificial, high-intensity, full spectrum light from about 7 to 9 A.M. often proves helpful.

Advanced sleep phase syndrome is much less prevalent and shows the reverse pathology to phase-delayed syndrome. Phase-advancing the sleep-wake schedule and light therapy during evening hours may prove helpful.

Parasomnias

Comment [5]: during high periods of stress, when people do not sleep enough

Comment [6]: can do a proposal about initiating thing in dallas, and research if it has been already done/ the effects

Parasomnias are events caused by physical intrusions into sleep that are thought to be triggered by the central nervous system. These dysfunctions do not interfere with actual sleep processes and do not cause insomnia or hypersomnia. They appear more frequently in children than adults.
Arousal disorders appear to be associated with neurological arousal mechanisms. They usually occur early in the night during slow-wave rather than REM sleep and are therefore not the acting out of a dream.
Sleepwalking occurs during sleep. The subject may seem wide awake but displays a blank expression, seldom responds when spoken to, is difficult to awaken, moves clumsily, and sometimes bumps into objects, although they will often maneuver effectively around them. Some sleepwalkers perform dangerous activities, like driving a car. Although rarely in the case with children, serious injuries can occur. Subjects displaying dangerous tendencies should take precautions like locking windows and doors. Episodes average about ten minutes, seldom occur more than once in any given night, and are seldom remembered.
Night or sleep terrors are sudden partial awakenings during non-REM sleep. Traditionally, a sufferer sits bolt upright in bed in a state of extreme panic, screams loudly, sweats heavily, and displays a rapid heart beat and dilated pupils. The patient will sometimes talk, and might even flee from bed in terror, often running into objects and causing injury. Episodes last about 15 minutes, after which sleep returns easily. There is seldom any recollection of the event. If woken, the subject may display violence and confusion and should, instead, be gently guided back to bed.
Rapid eye movement (REM) sleep parasomnias take place during sleep and include nightmares and the recently discovered REM sleep behavior disorder. This potentially injurious disorder is seen mostly in elderly men and results in aggressive behavior while sound asleep such as punching, kicking, fighting, and leaping from bed in an attempt to act out a dream. Subjects report their dreams, usually of being attacked or chased, become more violent and vivid over the years. Some sufferers even tie themselves into bed to avoid injury. Unfortunately, this disorder was seriously misdiagnosed until recently. It is now readily diagnosable and easily treated.
Sleep-wake transition disorders usually occur during transition from one sleep stage to another, or while falling asleep or waking up. Manifestations include sleeptalking, leg cramps, headbanging, hypnic jerks (sleep starts), and teeth-grinding.
Other parasomnias include excessive snoring, abnormal swallowing, bedwetting, sleep paralysis, and for some individuals, sudden unexplained death during sleep.

Diagnosis of sleep disorders

Identifying each specific sleep disorder is imperative for effective treatment, as treatment for one may adversely effect another. While sleeping pills may help in some instances, in others they exacerbate the problem. The most important step in diagnosis is the sleep history, a highly detailed diary of symptoms and sleep-wake patterns. The patient records events such as daily schedule; family history of sleep complaints; prescription or non-prescription drug use; and symptoms—when they occur, how long they last, their intensity, whether they are seasonal, what improves or worsens them, and effects of stress, family or environmental factors. Important contributors are family members or friends; for example, a bed partner or parent may be the only observer of unusual occurrences during the patient's sleep.

Sidebar: Hide

Comment [7]: how often and to what extent is the damage

Comment [8]: can make children fearful of sleeping in their own bed

Comment [9]: pretty subjective and could be potentially wrong

KEY TERMS

Apnea

Cessation of breathing.

Delta sleep

Slow-wave, stage 4 sleep that normally occurs before the onset of REM sleep.

Extrinsic

Caused by something on the outside.

Hypersomnia

Excessive daytime sleepiness.

Idiopathic

Disease of unknown origin.

Insomnia

Inability to go to sleep or stay asleep.

Intrinsic

Not dependent on external circumstances.

Parasomnia

Interruption of sleep by abnormal physical occurrences.

Polysomnography

Electronic monitoring equipment measuring brain waves, eye and muscle movement, heart rate, and other physiological functions.

REM sleep

Rapid eye movement sleep that is characterized by dreaming, active brain activity, and numerous eye movements.

Thompson, Marie L. "Sleep disorders." *The Gale Encyclopedia of Science*, edited by K. Lee Lerner and Brenda Wilmoth Lerner, 5th ed., Gale, 2014. *Science In Context*, http://link.galegroup.com/apps/doc/CV2644032037/SCIC?u=j043905010&sid=SCIC&xid=8be0403a. Accessed 10 Oct. 2018.